# RADIO

Incorporating 'WIRELESS & AVIATION NEWS"

MAY - 1922 * Price 15c


# A. R. R. L.

**First Canadian National**

**CONVENTION—EXHIBITION OF RADIO ENTHUSIASTS**

**Amateurs, Novices, Manufacturers, Jobbers and Dealers**

**PRINCE GEORGE HOTEL, TORONTO. SEPTEMBER 8-9, 1922.**

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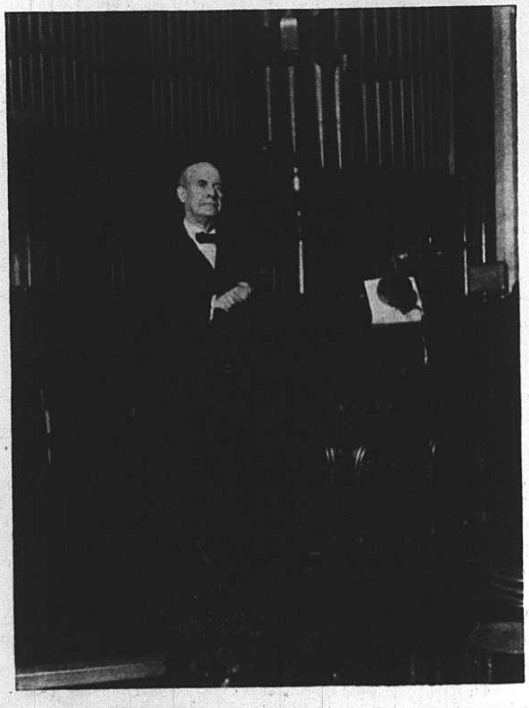

Under the auspices of the
**WIRELESS ASSOCIATION OF ONTARIO**

**C. E. WILLIAMS**
Publicity Manager

★ ★ ★ ★ ★

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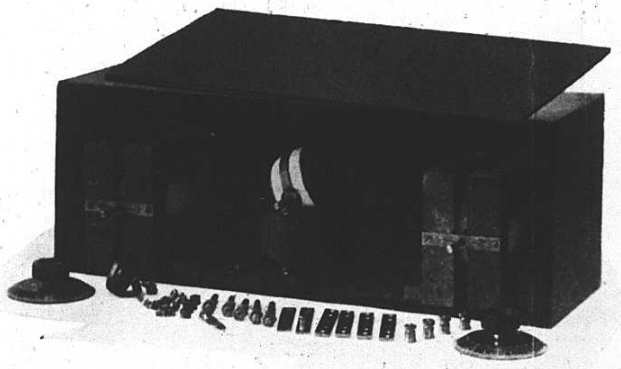

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Complete as shown above, with exception of Dials and Windings
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**Made-in-Canada**
**200—600 Meters**

Complete with Panel Drilled, Dials, Case, etc.
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The Set consists of—

1 Stained Oak Cabinet, 18″ x 7″ x 7″, removable top and back.
1 Polished Celoron Panel, 18″ x 7″ x 1/8″ to fit Cabinet
2 Variometers, 4¾″ square, mahogany wood, beautifully turned.
1 Winding Form for Stator Windings.
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1 Coupler Secondary Ball, mahogany turned.
7 Contact Points, 6 Binding Posts, 1 Switch Lever, 2 Stops.

Set Complete with all holes drilled, (except panel), all necessary brass parts, screws, etc. for assembling, with directions. Panel drilled $0.75 extra. Dials $1.10 each.

This complete set of parts assembled in an hour's time, is a most exceptional value at only $27.50 ($22.50) if you do your own winding) and is our contribution towards the lower cost of Radio. Each set is of perfect workmanship, and sold under a money back if not satisfied, basis. This is undoubtedly one of the greatest values ever offered. Place your order to-day and be convinced.

Variometer Parts separate, wound $5.00 Unwound $4.00.

Complete Vario Set comprising grid and plate Variometers and Variocoupler, all wound and ready to assemble $15.00. Cabinet only $5.50.

---

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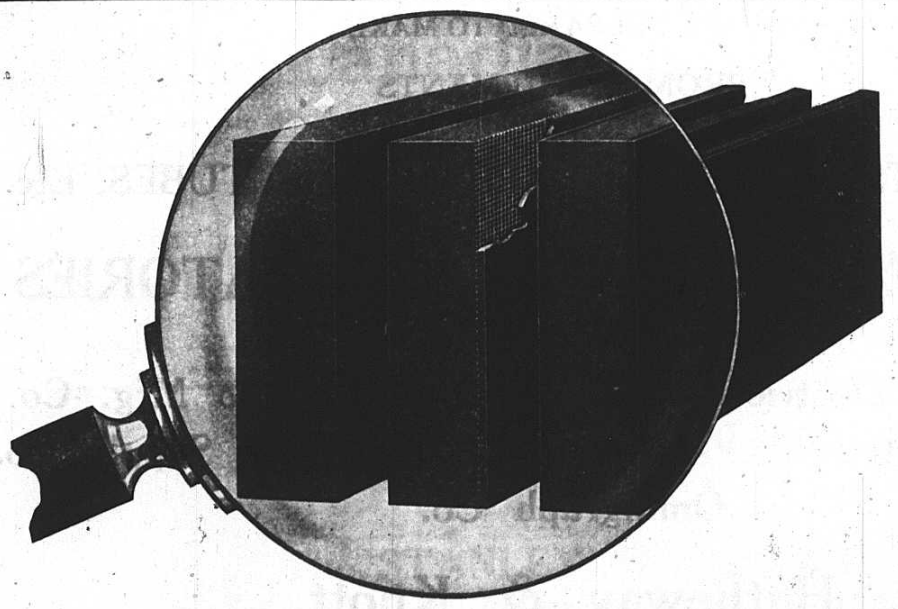
**THE ELECTRICAL SHOP**



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### CELORON FIBRE-VENEER

(patent applied for) is made of a hard fibre centre section veneered on both sides with Condensite Celoron Grade 10. It meets the demand for quality plus low cost. We recommend it for use in receiving sets and other apparatus where very high voltages at radio frequencies are not involved. It has the same fine surface as Grade 10 and similar machining and engraving qualities.

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(patent applied for) are made with a concealed copper wire mesh imbedded directly under the back surface of the plate. The wire shield, when properly grounded, very effectively neutralizes all detuning effect and "howl" caused by body capacities. This type of plate is made in both Condensite Celoron Grade 10 and Celoron Fibre Veneer.

## Send for our Radio Guide

Write to-day for our special "Radio Panel Guide," giving complete details regarding all Celoron Radio Panels. This guide quotes prices and enables you to determine just how much any type of Celoron panel will cost in either standard or special size—plain or fully machined, and etched to your own specifications. Don't fail to get your copy of this important Guide by return mail. Write us immediately.

DEALERS: Our Radio Panel Service enables you to sell panels completely machined and finished to the buyer's specifications. No waste. Write for our Special Dealer's Proposition.

**Diamond State Fibre Company of Canada, Limited**

**Head Office and Works— 235 CARLAW AVE., TORONTO, Ont.**

# RADIO

A. F. PENTON & Co., Publishers.

C. E. WILLIAMS, Editor & Business Manager
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# ADVERTISING BY RADIO

**By J. C. McQuiston**

The full possibilities of the radiophone are not yet known. The popular reception given to it during the past year has been sufficient to stir the whole of our population. Radio now takes the place of the weather and health as the chief subject of conversation. It is no wonder that just as soon as the public recognized the use of radio, advertisers gave consideration to this wonderful agency for spreading selling information. The experience that has been gained in th eshort time that the radiophone har been rendering service to the general public may even now give us a fair idea of some important limitations to this wonderful medium.

Whatever statements, however, that are now made, are based wholly upon the possibilities of the present development of radio sending and receiving apparatus. Of course, what may follow no one can tell, but even with the present limitations, the radiophone, as a means of broadcasting from a central point to great distances, will prove a wonderful benefit to mankind.

By way of preface, I wish to say that radio broadcasting will not, in my opinion, supplant, or interfere with newspapers as a medium of disseminating news, nor with concerts, churches, theatres, or movies, as entertainment features.

On the contrary, it has been proved that the broadcasting of news bulletins by radio and the publication of radio programmes have increased materially the circulation of newspapers. I will risk the statement that since radio broadcasting was begun, the total circulation of all newspapers has been considerably enlarged, and I believe the publishing of radio programmes and other features pertaining to radio by the newspapers has been responsible in a very large measure for this increase.

Churches that have broadcasted their services have actually found that the attendance of services has increased rather than diminished; and although it is true that some few members of the church may prefer to hear the services while lying in bed, there are hundreds who never go to church and who, hearing the appeal of the pastors, are not satisfied to receive all their sermons by radio, but will respond to that natural desire to hear direct, and to see the speaker.

The same thing is true with reference to amusements. Certain amusement houses have had connection with our radio service for over a year anl they are very glad, indeed, to continue the service because the hearing of artists by radio simply intensifies the desire to actually be present in the theatre to witness the performance.

In the sporting field, the hearing of the reports from the baseball diamond, play by play, and inning by inning, will not keep people away from the game. On occasions they will take their reports in this fashion, particularly if confined in a hospital, or at home, indisposed, or too far away to get to the ball park. However, the listening by radio will intensify a desire to be present at another time. I might go on to enumerate, but I think it is unnecessary to do so. It is clear enough, I think, that the radiophone will simply supplement the newspaper work, and entertainment work of all kinds, and is not an agency to fear, but rather one to make use of in the right way.

Amusement promoters, singers, and other artists were alarmed when the phonograph was introduced. However, as we all know, there was no need for alarm, because the phonograph has actually stimulated business for the theatres and other entertainment enterprises.

People, hearing the reproduction of voice on the phonograph, are impelled, when they can, to go to hear and see the artist.

We now arrive at the most important point of our discussion. If radio broadcasting is an agency that is rendering and can continue to render valuable service to the people, it must be protected. You remember the old song:

"Everybody's doing it,
Everybody's doing it,
Everybody's doing it now."

When there were few stations broadcasting from widely-separated centres, the reception was satisfying; at least there was little to disturb outside of the natural static conditions. However, quickly one sending station after another has been started, and to-day there are all over the country pretty close to 100 stations putting out programmes, if not nightly, occasionally.

It is clear, I think, that since all these stations are on the same wave length, 360 metres, there is bound to be increasing confusion, and that a government regulation

of wave lengths is positively imperative to maintain the efficient service of radio broadcasting. This control of the use of radio is in the hands of the Department of Commerce, now giving careful consideration to the general subject, and there is now recommended a band of wave lengths for radio broadcasting for the purpose of avoiding experiences of recent months of three and four stations broadcasting simultaneously.

However, irrespective of all this, let us come to the real subject of advertising by radio. Can it be done, and should it be done? Already the conference that has been in session in Washington to consider the proper regulation of radio broadcasting has recommended the prohibiting of advertising by radio. It is perfectly natural that this ruling should be made at this time, because if advertising were permitted, it goes without saying that all the good work that has been done in giving valuable information and pleasant entertainment for the people would be destroyed. This action of the committee is at this time very necessary, and those who have been enjoying radiophone service will surely appreciate the necessity for such action.

Let us think of the billboard for a few minutes. Why is it that the billboard has always had trouble? From the beginning there has been those who would remove it from the face of the earth. I think the answer is that somehow or another the billboard has been offensive to the people, and even though billboard promoters have raised the art to an exceedingly high standard, even in the face of this, billboard sign work is always in trouble with local and state associations.

We all know how persistently the advertising man has worked to get free advertising through the movie, and we know that it is pretty generally true that he hasn't got it. The reason is well known. The public will not stand for direct advertising when they go to see high-class moving pictures.

**Concluded on page 19**

## INDUCTANCE AND CAPACITY

Before the details of receiving and transmitting apparatus and circuits are taken up, a clear understanding of the meanings of inductance and capacity should be had. The efficient operation of sending apparatus and the tuning of receiving apparatus depends on the proper adjustments of inductance and capacity.

When an electric current flows through a wire a magnetic field is established about the wire. A compass needle placed near the wire will be deflected. If the current is stopped or if there is a variation in the intensity of the current the magnetic field will cease or vary in intensity and a current will be established in the wire in a direction opposite to that of the current which caused the magnetic field to be established. This is due to the fact that the fire is cut by the lines of magnetic force when the magnetic field varies in intensity and, as already explained, a current is set up in a conductor when it is cut by a moving magnetic field. This phenomenon is called self-induction.

If the wire is coiled the effect will be much more pronounced because the adjacent turns of the coil will combine their effects and the total self-induction will be much greater than if the conductor were a straight wire. The circuit is said to have greater inductance.

A circuit which can store electrical energy is said to have capacity. Do not confuse this with the storage battery which does not store electrical energy but changes electrical energy to chemical energy and later delivers an electric current by chemical reaction. A condenser is used to give capacity to a circuit. A condenser consists of two conductors separated by an insulator, or dielectric, as it is called. For instance, it may consist of two metallic plates separated by a sheet of glass, two conductors separated by air or sheets of tinfoil separated by paper. The aerial and the earth and the air between the two form a condenser. The capacity of the condenser depends on the nature of the dielectric, the distance between the conductors, the size of the conductors and the voltage or potential to which the condenser is subjected.

The wave-length of a circuit depends on the product of its inductance by its capacity. Two circuits are in resonance or in tune when the products of the two are equal. A receiving set includes inductances and capacities, the values of which can be varied, and the receiving circuit is tuned to the wave-length of the transmitting station by adjusting the values of inductance and capacitance.

### The Simple Receiving Set

The simple receiving set should include an inductance or a capacity, the value of which can be changed so that we can tune to the wave-length of the transmitting station. It must include a detector of some kind to rectify the inaudible radio frequency oscillations received from the transmitter circuit to an audible frequency which will act on the telephone receivers and produce an audible sound.

The variable inductance may consist of a coil of wire with taps taken off at intervals and brought to a series of contacts so that the number of turns in the active part of the coil can be varied. The inductance is connected in series with the aerial and the ground wire. When the wave-length of the three combined, that is, the wave-length of the aerial-inductance-ground circuit is equal to the wave-length of the passing ether waves from the sending station, this open-circuit, as it is called, will absorb the most energy from the passing ether waves and the open-circuit will be in tune with the sending station.

The variable condenser usually consists of two sets of metallic plates. One set is stationary and the different plates or sections are spaced a short distance apart. The other set of plates can be revolved so that they slide in between the plates of the first set, but at the same time do not touch. Since the capacity is affected by the space between the two sets of plates, it will be realized that maximum capacity is obtained when the leaves of the movable set are exactly opposite those of the stationary set and minimum when the movable plates are withdrawn. If this variable condenser is shunted around the inductance, that is, connected across the terminals of the inductance, it can be used to increase the wave-length of the open-circuit beyond that which could be secured with the inductance alone and it also permits of a closer adjustment of wave-length when used with the inductance because it gives a combination adjustment of both inductance and capacity. The inductance coil may have ten turns to the tap. Using the coil alone we could not get closer adjustment than in steps of ten turns. Using both inductance and variable condenser, we could get any fraction of ten turns.

The variable condenser may be connected in series with the inductance and ground or inductance and aerial to reduce the wave-length of the open-circuit,

**Continued on page 16**

## PROTECTING RADIO SETS FROM LIGHTNING

The purpose of this explanation is to off-set any fear in the reader's mind as to the possibility of the radio antenna conducting lightning currents into the house, so states Mr. L. S. Brach, writing in an exchange. Generation of lightning is the building up of small charges of electricity which accumulate on moisture. These charges combine as the moisture forms into fog, clouds and raindrops, and subsequently become so heavy as to discharge to other clouds or to the earth. It is the presence of moisture in the air that permits the conductance of the discharge between the clouds and the earth.

The damage done by lightning may be caused either by the direct stroke of the discharge striking a wire or by an inductive charge being built up in the wire by reason of the flash of lightning passed between two clouds or between clouds and the earth. All lightning discharges have an area of electrification, and wires located within this zone are subject to the induced potential which would, if not properly side-tracked into the earth, enter into the apparatus and result in damage. Direct discharges are always too violent to be protected against except by the antenna wire itself, which generally melts and breaks the circuit. Even a heavy switch will not cause suitable protection, but the possibility of such a condition occurring would be no greater with the antenna than it would be without.

The strength of the induced charges in lines depends upon the nearness of the direct discharge, length of line, and its position in the electrified zone. It is safe to say that the longer the antenna circuits, the more subject they are to being affected by passing storms. These tests reveal that discharges occur in two different ways; one is the brush discharge in which lightning passes through insulating material readily and is harmless in passing; the other occurs in a line of thread-like discharge and with it sufficient heat is produced to cause damage to the parts between which the discharges occur. In the designing of arresters, we treat only with the latter type of discharge, and it is essential that protectors must carry such discharges freely and without injury to themselves. The most efficient arrester is therefore one that will instantaneously and repeatedly dissipate the largest amount of energy without being affected.

The potential at which an arrester should discharge should be determined by the insulation of the apparatus or circuits that are to be protected. For example: If the apparatus is tested to withstand 500 volts between its windings and other parts, the protector should discharge at a potential of approximately 375 to 400 volts, that would insure an operation of the arrester in preference to the damage of the insulation. It is possible to design arresters that will discharge at different potentials to a certain degree, but in this we are limited in getting below 375 volts in practical types of arresters.

Another test which will reveal the sensitiveness of an arrester to static current is the comparison of the efficiency of the arrester with an adjustable air-gap, thereby getting an air-gap equivalent. The process in doing this is to have two needle points supported in a way that a micrometer adjustment may be had. These are to be held in multiple with the arrester and an electric generator. The separation at which the needle gap is adjusted when the arrester will start to assume the discharge in place of its passing across the needle point would give a value to the arrester as in the air-gap equivalent. Therefore when we say a certain arrester has an air-gap equivalent of .001 or .002, we mean that the arrester will start to discharge the current from a generator when held in multiple circuit with a needle held that distance apart.

There are three principal designs of lightning arresters, the air-gap, vacuum, and high resistance types. In addition to this there is the choke coil, but choke coils, when used, are generally found in combination with one of the three types mentioned. The air-gap design depends on its efficiently bringing close together two electrodes, one connected to the line and one connected to ground. The air between the two electrodes acts as the insulation for the normal operating currents. Air-gap arrester electrodes are generally made with carbon or metal as the conducting medium forming the electrodes. The efficiency of this arrester depends on the closeness of the two electrodes. It is necessary to keep in mind that in this design, there is always present danger of the two electrodes fusing together by passing discharge or the serrated points burning back and its effectiveness thereby changing—due to the lengthening of the gap.

The vacuum arrester consists of two electrodes held in a fixed position in a sealed chamber from which the air has been exhausted, and through this vacuum we find that inductive currents readily pass, even when the electrodes are held much farther apart than in the air-gap types, and equally good results obtained. The vacuum types are practically free from the fusing together of electrodes or the collection of moisture or dust on the operating parts. It is a well-known fact that discharges will occur at a lower potential between conductors at a given separation in a vacuum than in air, and this fact has been taken advantage of in the designing of protectors so as to provide protectors of low voltage potential discharge value having a fairly high carrying capacity.

The high resistance medium arrester consists of a composition block, generally a mixture of carborundum or silicon with a clay binder, placed between the line and ground. The carborundum has the property of conduction and the clay binder acts as an insulator. The binder being porous and the conductive material being in very small particles, it is found that when mixed together we have an insulating mass with small conductive particles that arrange themselves in a way that the total mass is of exceptionally high resistance, but static current will pass from particle to particle through the binder and then discharge itself. While this type of arrester is sensitive to static current it will not discharge at a low potential, and is therefore of little value for protection against crosses, but highly sensitive to lightning induction.

For radio antenna protection we have depended entirely on the efficiency of the vacuum type. We believe it is the best suited, inasmuch as with the other types, if constructed on efficient ilnes, they would take off, or cause to be lost, some of the radiophone voice currents, thereby affecting the strength of the receiving current to that extent.

### Tube Reception

Tube reception with a. c. lighting current, thus doing away with the necessity of batteries, is being developed by the U. S. Bureau of Standards. Briefly, the scheme is to utilize a 60 cycle lightning for both filaments and plates of the electron tubes. The amplifier recommended in the report has three radio-frequency stages, and two audio-frequency stages, and requires a crystal detector. A 60-cycle current when used in an ordinary amplifier carries a strong hum, or ripple, offering serious interference with messages, but this is eliminated by balanc-

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# Broadcasting and The Blue Sky Wizards

**By an Old-Time Amateur**

With the advent to Canada of Radio broadcasting, comes the usual scourge of sucker hunters that attach themselves to every business boom. The Wallingfords are here with the whole family, doing it all over again.

We went into a store recently to interview the proprietor of the new radio display shown in his windows. Oh, yes! he knew all about Radio. "Nothing to it; people buying anything and everything that had even a radio flavor to it." We pointed t oa well-known make of intervalve transformer which a few weeks ago was retailing at $6.25 at the regular dealers. "$9.65," said friend Wallingford, and never even blinked an eye. This man in the course of his conversation stated that he had spent $1,500.00 "investigating" the patent situation before going into the business. Now it cost us about $800.00 to learn all there was to know about Radio patents, and we became curious to know if we had missed something. We enquired of our host's knowledge regarding the Armstrong patent, which, of course, is the key-patent of the whole business of Radio. It developed that he knew nothing at all about the Armstrong patent, and, if we may judge by his suddenly puzzled expression, we doubt if he had even heard of it before. This same man secured by some means the Canadian distributing end of a new article. He sallied forth and secured large orders from local dealers, quoting them $15.00 each less 25%. Having thus loaded the local men up with an article of untried merit, he proceeded to sell them at $12.00 each in his own retail store. Now the other dealers are beginning to think they maybe picked a toadstool instead of the mushroom they thought they were getting.

We chanced one day to be at the Radio counter of a well-known retail store when the salesman was displaying a certain make of crystal receiver. The customer obviously knew nought of Radio. He was asking all sorts of questions. Most of them were foolish, but our thoughts went back to those halcyon days of 15 years ago when we hooked up our first crystal detector and heard old "WCC" pounding out the press at 2 a.m. We thought we knew just what to expect of a crystal detector set, but when the eloquent salesman behind that counter got through telling friend customer all about the fabulous range and selectivity of that rediculous little box, our thoughts again wandered backward, this time to pick up that well-worn phrase, "There's one born every minute."

Even some of the big manufacturers are not playing fair with the public. One firm of international reputation is marketing a "crystal receiver" that is nothing short of a monstrosity, yet the public is buying it—on the firm's reputation? Do the makers of that receiver foster the claims as to range and selectivity that are being made by the retailer?—We wonder.

The effect of such merchandizing methods is bound to react adversely upon the innocent as well as upon the guilty. Already, dealers say, business has shown a quiet turn. This may be due partly to the inferior quality of entertainment supplied by Canadian broadcasting stations. The public is a little disappointed; they thought Radio was to oust the phonograph. But somehow it's not as good as they expected. The artists that sing and play are good—the very best; but the reproduction is poor. People are disappointed. They have not all heard the sweet, clear, ringing tones of KDKA and of WGY. They are going to wait. When the owners of Canadian broadcasting stations have learned that stations like KDKA and WGY have set a standard of quality to which they must live up, then and only then will business resume its booming sweep. Meanwhile, the public is busy learning all it can about Radio,—meanwhile, the manufacturers who would not stoop to the production of Radio rubbish, will have had time to get a product of real merit on the market in sufficient quantities to meet the new demand. By that time the public may have learned what to buy and what to leave alone. And by that time we hope that Mister Wallingford may have found a gold brick somewhere else than in Radio. We would like to see our hobby —Radio—kept clean.

## W. A. O. O.

Next meeting of the W. A. O. O. will be of an informal character.

All members and friends should be sure and come to the big event.

Don't forget the *place* and *date*.

Stanley Piano auditorium, 241 Yonge St., Toronto, Thursday, May 25th, 1922, at 7.45 p.m.

Smokes, eats, games and nonsense. Lots of fun. Come and make yourselves at home.

## WESTINGHOUSE SALES FOR THE YEAR $100,000,000

In spite of the extremely adverse conditions of the past year, the sales of the Westinghouse Electric & Manufacturing Company of the United States amounted to almost exactly $100,000,000, as shown by its annual report, as of March 31st, 1922. This is the largest volume of business handled by this company except during the abnormally active previous three years.

Chairman Guy E. Tripp states in his report: "The contraction in orders booked continued throughout the year until January, 1922, when there began a substantial improvement which has since been maintained. In addition to the favorable indications for an increasing demand for the regular lines of your company's products, a large demand for radio telephone receiving apparatus has recently developed with a prospect of its continuance for an indefinite period. It should be pointed out, however, that the ensuing year promises to be a period of keen competition."

## QUEBEC DISTRICT AMATEUR RADIO ASSN.

Officers—E. Fontaine, president; D. McWilliams, vice-president; L. P. Soucy, secretary-treasurer.

The club started about a year ago with 15 members, and now has 75, all of which have a tube receiving set of their own. This is one of the conditions of membership.

This is a real live club, and the boys all take a keen interest in it.

## POWLEY & MOODY, LIMITED

Powley & Moody, Limited, announce that they have installed a complete receiving equipment in their offices at 105 Bond Street, Toronto, and are demonstrating Mullard valves, Bristol loud speakers and allied accessories for the trade.

## STEEL TOWERS

The Ontario Wind Engine & Pump Co., Toronto, are offering aerial steel towers and poles of all heights, a line for which there should be many enquiries.

## MOTOR SUNDRIES CORPORATION

A complete line of radio equipment is being made by the Motor Sundries Corporation, 420 Eastern Avenue, Toronto.

## STATIC WILL BECOME INCREASINGLY HEAVY THROUGH HOT SEASON

For the benefit of the winter crop of radio fans to whom everything in wireless is new the following concerning static is published. To the "old timer" it is just another sign of spring and not such a pleasant sign at that. Static, according to the dictionary, is "an electric charge at rest," but the experienced operator has a definition which is more forceful than explanatory, so we will pass it, merely saying that it is a confounded nuisance.

Static is seasonal and largely confined to the regions frequented by thunderstorms. The eastern part of the United States and Canada, South America and the north-eastern Atlantic regions are in the static zone. The Pacific coast, however, is practically free from this bugbear of all wireless folks. The early spring ushers in and introduces a new condition that will be with us more or less constantly through the next six months. This condition is caused by electrostatic charges floating in the air. You will find that this phenomenon, while described as electricity at rest, is the most animated something that you have ever met up with. It reminds us of the circus' trick burro, which always looks asleep until one tries to touch him—then it is very much alive. Thus it is with static. It floats aimlessly around in the moisture of the atmosphere until it comes in contact with a radio antenna, which forms a beautiful connection with the earth. This is just what it has been looking for—some way of getting to earth—and down it dashes, crashing through everything and making the most hideous noises imaginable in the receivers. It cannot be tuned out—so we just have to suffer it. The rumble or small cloud-to-cloud discharges, not accompanied by lightning, is also heard with characteristic static crash.

Lightning is caused by static charges of great power jumping from one cloud to another or to the earth. The accumulation of electricity in the moisture of the clouds is continually increased until it becomes of sufficient strength to break down the resistance offered by the air, and then it "jumps," causing lightning. The lightning is heard in the receivers of a wireless instrument with its hissing, scraping noises to the exclusion of everything else. It is the electric waves set up by lightning that causes all this trouble.

In the spring, summer and fall the air is filled with static charges, large and small, which are forever breaking in on some concert or message and being roundly cursed by everybody. It is possible to foretell an electric storm by several hours by the use of a radio receiving set, as small static discharges are heard with increased frequency and intensity as the storm approaches.

While on the subject of electric storms it is well to issue a warning to all fans: "Do not try to use or operate your instrument with an outdoor antenna during a thunderstorm. Such operation may result in bodily harm or the destruction of your instrument."

A loop aerial is the only type of antenna that is not subject to static influence. Engineers are working on instruments that it is hoped will eliminate this trouble, so in the future we may enjoy our concerts and news with utter disregard of electric storms.

## NEW CANADIAN BROADCASTING STATIONS SINCE APRIL 13TH, 1922

| *Name.* | *Wavelength.* | *Call Signal.* |
|---|---|---|
| **Montreal** | | |
| La Presse | 430 metres | CKAC |
| Bell Telephone Co. | —— | CKCS |
| **Toronto** | | |
| Metropolitan Motors | 410 metres | CHVC |
| Bell Telephone Co. | —— | CFTC |
| **Winnipeg** | | |
| T. Eaton Co. | 450 metres | CKCB |
| **Calgary** | | |
| E. Taylor | 420 metres | CJCY |
| Morning Albertan | 410 | CHBC |
| Western Radio Co. | 400 | CHCQ |
| **London Ont.** | | |
| London Advertiser | 430 metres | CFCX |
| London Free Press | 430 | CJGC |
| **St. John, N.B.** | | |
| McLean Holt & Co. | 400 metres | CJCI |
| **Ottawa, Ont.** | | |
| J. R. Booth | 400 metres | CHCX |

## 185 BROADCASTING STATIONS IN U. S.

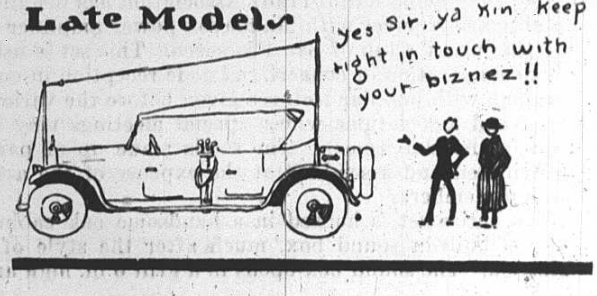
Since October 1 last year the radio inspectors of the nine radio districts of the United States have been very busy making out broadcasting licenses and inspection tours to the various stations. Up to April 15 185 radio broadcasting stations were licensed in the United States.

## U. S. RADIO CHAMBER OF COMMERCE

At a meeting just held in New York, the newly organized National Radio Chamber of Commerce definitely outlined plans and elected temporary officers. The officers elected at this meeting are—President, Alexander Eismann, of the Freed-Eisemann Radio Corporation; 1st Vice-President, Charles Keator, of the De Forest Radio Telephone and Telegraph Company; 2nd Vice-President, William Dubilier, of the Dubilier Condenser Co.; Secretary, Frank Hinners, of the Home Radio Corporation, and Treasurer, Joseph D. R. Freed, of the

## GILBERT-MENZIES CO., LTD.

The Gilbert-Menzies Company, King Street West, Toronto, have been in the wireless business for several years, and in addition to handling their standard "Gilbert" line are extending into higher priced equipment.



Concluded from page 13

ing resistances, grid condensers and special grid leaks of comparatively low resistance, a telephone transformer in the output circuit and a crystal detector instead of an electron tube. It is said that the amplification was as good with alternating current as with direct. The complete set is light and compact for portable use.

According to expressions heard in many countries the advent of radio has perturbed the music trades. Decreased phonograph sales are attributed to the increased sale of receiving sets. Music publishers are commencing to require royalties on songs sung over the radio and actors' associations are forbidding their members to broadcast their acts. The musicians' unions are fearful that radio entertainment and dance music will kill the market for their services.

Yet these are short-sighted and selfish views which will soon be broadened as the real vision and musical mission of radio is better understood. Increased sales of phonograph records advertised over the air will partly compensate for decreased sales of instruments. Music publishers will find it more efficient to introduce new songs to big audiences by radio than by hiring "pluggers" to sing before small audiences. Actors will realize that theatre-goers want to see as well as hear. Musicians will find a great demand for their services at broadcasting stations. And all should realize that it is useless to try to stem the tide of progress.

But these brief reasons as to the futility of opposing radio entertainment are trivial as compared with the tremendous popular interest and education in matters musical that ridio is stimulating. It has long been recognized that anything bringing music to the people promotes the sale of musical instruments in the home. After a person has enjoyed a certain piece of music over the air, the desire is created to hear it often with an instrument of his own instead of waiting until the piece is again broadcasted. No better means can be imagined for popularizing classical music and teaching the people to discriminate against jazz. So, without question, radio should be welcomed as an able instrumentality for advancing the cause of better music.

Furthermore we venture the prediction that every music house will soon sell radio receiving sets. Many are already doing so, two of the largest manufacturers of musical instruments are now making and selling radio sets to the music trades, and the logical step is for the phonograph people to get into line with radio equipment housed in handsome cabinets of period furniture as an ornament to the home. Radio is not a competitor but an active co-operator in bringing an appreciation of music to all the people.

## TRADE ASSOCIATION INSTALLS DEMONSTRATION SET

As part of a comprehensive campaign of radio education the Pacific Radio Trade Association has installed an all-wave receiver with Magnavox power amplifier in the Engineers' Club of San Francisco. This set is used for demonstration of concert and code reception in conjunction with popular lectures given before the various clubs and associations whose special meetings may be held in the club rooms. The set is made up of parts contributed and assembled at the expense of the association members.

The entire set is housed in a handsome oak cabinet with a built-in sound box, much after the style of a Victrola. The sound box opens in a grill 6 in. high and 22 in. wide. Across the front of the cabinet, beneath the grill, is a pair of glass doors, behind which are placed the tuning apparatus and detector controls. The lower portion of the cabinet has a pair of oak doors. The power amplifier, the storage battery, B batteries, the battery charger and space for accessories, are in this lower box.

The storage battery is provided with vents which carry the gases given off by the solution out through the rear of the cabinet, thus preventing these fumes from injuring the apparatus. A switch throws the storage battery to either charge or discharge, and a voltmeter shows the condition of charge. The only terminals on the exterior of the cabinet are the aerial and ground binding posts and a cord and plug for connecting to an A. C. lamp socket, to provide the current for charging the storage battery.

A pair of phones is provided so as to be plugged in instead of the loud speaker for tuning in the various stations. Duolateral coils are used for wave-lengths over 600 meters, but for amateur work and music broadcasting, a short wave regenerative circuit is used, consisting of a variometer and two variocouplers. A "wiggle" switch is used to select either the short or long wave tuning apparatus.

The experience of a great many who have tried to combine short and long wave tuning apparatus has been that efficiency was sacrificed in doing so. This difficulty has been overcome in the present set by a rather novel circuit, so that both long and short wave apparatus are just as effective as if either was used alone for its particular work.

## INDUCTANCE AND CAPACITY

Continued from page 12

thus giving an effective wave range lower than could be secured with the inductance alone.

**Remember this**—A condenser in multiple with an inductance is used to increase wave-lengths and a condenser in series with an inductance is used to decrease wave-lengths.

The detector of the simple receiving set must be fairly sensitive, easy to adjust and should not require the use of a battery to operate it.

But before the advent of the vacuum tube detector, crystal detectors were used almost universally. There was one form, the electrolytic detector, which consisted of a very fine platinum wire dipping into a solution of 20 per cent. nitric or sulphuric acid, the rectifying action depending on the electrolysis which takes place. But in those days radio apparatus was hard to procure and the amateur usually had to make his own and it was some job both to make and operate an electrolytic detector—and platinum wire came high.

The carborundum crystal was introduced about the same time and the writer remembers using this form in commercial work aboard ship back in 1912. It was very crude as a detector, but it had a faculty of holding its adjustment when the ship was buffeted about.

The silicon detector followed and then the Perikon and the Pyron (special crystals) and finally came the galena. For all around work the galena is perhaps the best. A galena crystal is held firmly in a clamp and a very fine, bare copper wire (No. 36 or smaller) is fastened to a movable arm so that its end can be made to touch the crystal at different points and with varying pressure. The point of the wire is run over the crystal

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## FINAL RECOMMENDATIONS FROM WASHINGTON RADIO CONFERENCE

The final recommendations from the Washington Radio Conference are much the same as the tentative recommendations as printed before, with a few important changes as noted below. These recommendations are embodied in a bill to be presented to Congress and probably to be passed during the present session, after which they will become effective.

In the final recommendations four bands are provided for government and public broadcasting, 1050-1500 metres, 700-750 metres 200 miles or more from the seacoast, 650-700 metres 400 miles or more from the seacoast, and 485-495 metres.

For private and toll broadcasting is alloted a band from 285 to 485 metres except for coastal regions where 285-315 metres and 425-475 metres must be kept open, and for border regions account should be taken of wavelengths used in neighboring countries. The band 100-150 metres is also allocated for this service.

The wave band from 525 to 650 metres is reserved for marine radio telegraphy.

A restricted special amateur wave of 310 metres is allowed for use by a limited number of inland stations where it is necessary to bridge large sparsely populated areas as to overcome natural barriers.

The band from 275 to 285 metres is for city and state public safety broadcasting and by special arrangement to private detective agencies.

Amateur telepraphy and telephony is assigned an exclusive band from 150 to 200 metres and from 200 to 275 metres in conjunction with technical and training schools where radio instruction is given. An amateur is defined as "one who operates a radio station, transmitting, receiving or both, without pay or commercial gain, merely for personal interest or in connection with an organization of like interest."

It is recommended that damped wave stations be assigned the band of lowest wave-lengths, interrupted or modulated continuous wave radio telegraphy stations the next band, radio telephone stations the next band, and finally unmodulated continuous wave radio telegraph stations the band of highest wave-lengths. It is recommended that amateurs be permitted to carry on broadcasting within the wavelength band assigned by the Secretary of Commerce to amateur radio telephony.

The degree of public interest attaching to a private or toll broadcasting service is to be considered in determining its priority in the granting of licenses, in the assignment of wave frequencies, and in the assignment of permissible power and operating time, within the general regulations for these classes of service.

It is recommended that direct advertising in radio broadcasting service be absolutely prohibited and that indirect advertising be limited to a statement of the call letters of the station and of the name of the concern responsible for the matter broadcasted.

It is recommended that when all available wave frequencies in any geographical region are already assigned, no further licenses for broadcasting be granted in that region until cause arises for the revocation of existing licenses.

It is recommended that private or toll broadcasting stations transmitting time signals shall transmit only official time signals and with authorization from and under conditions approved by the Secretary of Commerce and that the transmission of signals of such character or wavelength as to deliberately interfere with the reception of official time signals constitutes grounds for the revocation of suspension of the transmitting stations or operator's license.

It is recommended that license requirements for the operator of a radio telephone transmitting station include a knowledge of radio transmitting and receiving apparatus and of the International Morse Code, sufficient to receive at a rate of not less than 10 words per minute.

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## MEETING THE DEMAND FOR RADIO

It is announced by the Radio Corporation of America that the April production of vacuum tubes reached 150,000. The production schedule for May calls for a total delivery of 175,000 vacuum tubes. The programme will reach 200,000 or more in June, according to public and trade requirements.

Crystal detectors served the purposes of most amateurs in the early days. The great demand for vacuum tubes is a development of the past three months, due entirely to the sudden popularity of broadcasting. Although machines play a part in the major processes of manufacture, tubes are still largely made by hand. Hand work plays a far more important part in making vacuum tubes than in any other piece of electrical apparatus with which the public is familiar. Manufacture of the delicate vacuum tubes used as detectors, transmitters and amplifiers, has been subject to the usual difficulties in bringing about quantity production.

During the first eleven months of 1921 the factories produced for the Radio Corporation of America an average of 5,000 tubes per month. This rate of production, small as it seems now, was gradually producing a surplus. Then suddenly in one or two territories broadcasting jumped into popular favor over night. On December 30 the production schedule was increased to 40,000 tubes per month. In January of this year the Radio Corporation of Aemrica pushed the schedule to 60,000 per month—a figure largely in excess of the demand at that time.

The present concerted demand, due to the further expansion of broadcasting, came early in February. On February 3 the factories were asked to do everything in their power to reach 75,000 vacuum tubes—to try to reach it during that month. They did their utmost. They came close to the production goal, and the following month, March, they not only reached 75,000, but bettered it by several thousand. April calls for 150,000 and May for 175,000.

In the event that no surplus results from the present expanded programme, facilities will be further increased. It is easier to increase production now than it was four months ago, because it is easier to increase the size of a large and well trained organization than to build a new one. Technically trained forces are required in the factories, which are working with skill and energy.

# Protecting American Radio Industry

The purpose of the National Radio Chamber of Commerce is to remedy certain conditions which have arisen in the radio industry as a result of its tremendous growth within the last few months, and to group together manufacturers whose radio products are of such dependable character as to maintain favorable public opinion toward the radio industry.

It is stated that all radio manufacturers, whether large or small, will be eligible for membership. The original group consisted of about fifteen manufacturers. To this body there will be added, by invitation, about twenty additional concerns whose business standing and whose products are known to be of high order. New concerns will be eligible after their apparatus has been passed upon by a board of five members. This board will be appointed at the next meeting after new members, whose products have already been passed upon, are added to the membership list.

It is planned to exclude from the membership various concerns which have been organized purely for stock-jobbing purposes, and to exclude also manufacturers who are now turning out radio apparatus which has been found to be untrustworthy and which will eventually bring radio into disfavor on the part of purchasers of such undependable apparatus.

It is also stated that a large number of persons have entered into the business who are placing on the market carelessly constructed merchandise, which, after a few months' use, will be worthless in the hands of the consumers. Many of these concerns are innocently infringing upon existing patents. This infringement is due to the fact that the financiers back of these concerns have taken for granted the advice of some so-called expert, and, therefore, through ignorance or unscrupulousness, are clearly infringing Government granted rights either in the form of patents or patents-applied-for of the older manufacturers.

Among those who addressed the meeting, besides the officers mentioned, were Mr. Andrea, of F. A. Andrea & Company, and Messrs. Russ and Taylor, of the law firm of Pennie, Davis, Martin and Edmonds,—which firm has been appointed counsel for the National Radio Chamber of Commerce.

It is also planned that this body will decide whether or not its members should take part in public radio shows, many of which have been started through the country and run merely for the purpose of exploiting manufacturers' and the public's interest in Radio. The Chamber of Commerce does not plan to undertake the organization of radio shows, on its own part, at this time.

A Credit Bureau will also be organized shortly, for the interchange of credit information.

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**R. F.**

Radio frequency amplification is another new idea which everybody in radio is anxious to know more about. Within a very short time we will have the results of some interesting experiments and a series of latest hookups for radio frequency. This material will be in the form of charts and blueprints, technically correct, but so simple that anyone can use them.



## NEW WESTON REPRESENTATIVES

The Weston Electrical Instrument Co. of Newark, N.J., announce the appointment of the following sales representatives:

Shiefer Electric Co., Inc., with offices at Rochester, Buffalo, and Syracuse, for upper New York State and Erie, Pa.

L. D. Joralemon, Otis Bldg., Philadelphia, Pa., for Pennsylvania, Delaware, Maryland, and District of Columbia.

Warren C. Graham Co., Carondelet Bldg., New Orleans, La., for Louisiana, Mississippi and Lower Alabama.

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## BURGESS BATTERY CO.

The well-known Burgess Battery Company of Madison, Wisconsin, are taking active steps to keep pace with the demand for their products in Canada. Some time ago they opened a branch factory at Winnipeg to cater to Western Canadian trade. Their vice-president from Chicago and Mr. L. R. Baker from Winnipeg went to Eastern Canada the early part of May in order to look over the field before completing their plans for manufacturing and distributing their products in that section. In next issue our readers will have the opportunity of hearing more about their products through our regular advertising columns.

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## NEW RADIO FIRM IN MONTREAL

Semmelhaack-Dickson, Limited, well known in Montreal as old-established motor boat dealers, etc., have opened an up-to-date radio department, which will be in charge of Mr. G. S. Johnson.

Let me ask you whether the public will wish advertising to come to them through the agency of radio broadcasting. Remember that this advertising will go right into the home. It will invade the place where the family is enjoying the full benefits of privacy and detachment from business cares. The broadcasting to thousands of homes of advertising information concerning, say: "things for women and things for men;' probably the butcher with his meats; the baker with his bread; the tailor with his clothes, and the grocer with his crackers and cheese—what kind of a home will it be anyhow? You may say you can turn it on at will and turn it off when you want to, but even so, who will want it? How valuable will be the media if the public will not support it? Personally, I don't think they will support it.

Advertising must ride on some service, and in riding on that service it must not destroy the service. The editorial page of a publication pretty generally determines the quality and extent of the circulation. Therefore, the value of a medium for advertising must always play second fiddle to the editorial and written pages. It is, therefore, true that advertising must "stand by" until it finds a way to associate itself with radio broadcasting without, in any way, destroying the refinement and enjoyment and general satisfaction that comes from receiving news bulletins, baseball scores, lectures, sermons, bedtime stories, concerts, etc., etc.

Has advertising been tried by radio? In our own case, at the beginning of our broadcasting work we mentioned, for a short time, our heating appliances and those things made by us that generally appeal to the public. We very soon found out that the people revolted at this sort of thing. They felt that we were cheapening something that was well worth while. This came to us so forcibly that we quickly dropped it, and we have not been advertising anything, not even our radio apparatus, in connection with our broadcasting work.

I recall one experience that came to me shortly after trying out advertising by radio. One day last year when I visited Indianapolis and met a number of business men there, I was quizzed a great deal about radio broadcasting, and I told them something of the starting up of the mother station, KDKA, at Pittsburgh as a regular broadcasting station. One of the business men present asked for the privilege of telling of the experience he had had, and this being granted, he described a visit he had made to Chicago to buy a Westinghouse receiving set with all supplemental equipment. He pictured his return home and the work entailed in putting up the aerial and connecting up the battery, and that sort of thing. Then he explained that the first thing he heard was: "Electrify your home and make it modern for good housekeeping. Use electric ranges, coffee percolators, toaster stoves, and electric irons. If you are interested in a standard of quality, ask for Westinghouse."

"Now," said the speaker, "for all of this I went to Chicago and spent several hundreds of dollars and a great deal of my time to install it, only to get some advertising matter."

Now, of course, my friend told this half in jest and half in earnest, and yet it proved to me that advertising was the thing that would not easily find a welcome in the radiophone programme, and our company, since that time, has omitted advertising from its broadcasting programme.

There is a kind of advertising, however, which for want of a better term may be called "collective and educational," which, if properly censored, may be made a part of radio broadcasting programmes; for example, talks on styles for women, the well dressed man, sanitation, the value of a photograph, etc. Addresses of this kind, not inspired by any particular institution, but given out unselfishly, naturally develop an increase of business. Some work of this kind has been done, and I believe the public will support this sort of thing.

In closing, I give as my opinion that advertising must be inoffensive to the public, and any advertising that enters the home must be welcome. If it is in any sense an intruder, it will fail just as an agent at the door is turned away if his appearance or manner is objectionable.

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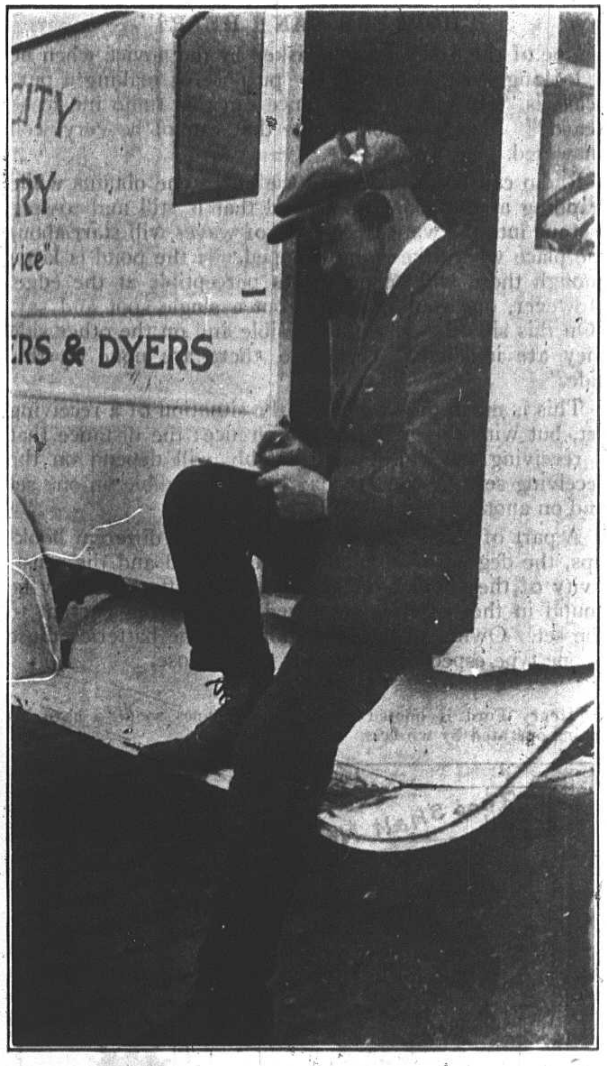
## NOVEL USE FOR RADIO IN LONDON, ONT.

Radio phones are all the rage and have been going ahead with leaps and bounds, and it has just taken another leap—this time from the commercial business house and the dining room of a residential house to vehicles on the street.




The Forest City Laundry (London, Ont.) have just completed installing radio phones on their delivery wagons, and the management has voted the innovation a huge success. It is now possible when an urgent call for a delivery man is received for the office staff to communi-

cate with the drivers, who are instructed to "listen in" at certain times each day.

A small aerial six inches high has been found satisfactory. Our correspondent advises us that other London, Ont., firms are also considering the placing of Radio sets on their wagons, and it is quite probable that before long the "stunt" will be universal.

## RADIO BRIGHTENS LIGHTHOUSES

Through a programme of social service instituted by the Lighthouse Commissioner of the Department of Commerce, the Navy Department is preparing to equip coastal lights with radiophone receiving apparatus out of its surplus war stocks. This move was decided upon as a means of brightening the long days and nights at lonely posts, where amusement is rarely afforded those whose duty it is to keep the beacons blazing off danger spots along the coast.

## "HOW FAR CAN I HEAR?"

One of the first questions asked by the novice when he is looking over outfits for the purpose of making a purchase is, "How great a distance can this radio music be heard?" This question is one that cannot be very well answered.

Radio can be compared to the effect one obtains while standing at the shore of a pond that is still and tossing a stone into the water. A circle of waves will start about the place where the stone dropped. If the pond is large enough there will be no waves perceptible at the edge. However, one could not pick out a single spot and say, "On this side the waves are visible and on the other side they are invisible. Therefore, there are none on this side."

This is much the same as in the situation of a receiving set, but with this important difference: the distance that a receiving set will receive audibly will depend on the receiving set. A concert may be quite audible on one set and on another may not be heard at all.

A part of this difference may be due to different hookups, the degree of amplification employed and the sensitivity of the phones. A great deal of difference may be found in the batteries employed in supplying current to the set. Owing to the importance of the batteries there is one type especially made for the purpose.

Henry Ford is quoted as saying he hopes soon to have his trains operated by wireless.


## RADIO EXPOSITION TO BE HELD IN CHICAGO

The Chicago Radio Show to be held at the Coliseum, October 14 to 22, is rapidly assuming not only definite proportions, but promises to be of unusual interest to the radio trade in general. The Coliseum, being recognized internationally as the centre of trade expositions, gives any exposition held there prominence throughout the country.

U. J. Herrmann, the Managing Director, has opened permanent offices in suite 549, McCormick Building, and has appointed James F. Kerr manager of the exposition. Many novel features in the arrangement of floor space are being worked out to make the exposition of equal interest to manufacturers and the public in general. Applications are coming in from all corners, and the first foreign application was received from Paris, France.

Details of the show are now being perfected. The floor plan will soon be ready, and the rates for space will be kept low in order that the largest variety of exhibits may be attracted. The show will be the first real attempt at bringing the buyer and seller of radio equipment together since radio developed into its present proportions, and it is expected that the attendance will include thousands of the foremost radio men from Canada and the United States.

## DIRECTIONAL WIRELESS

"Commercial Airships," written by H. B. Pratt, M. I.N.A., Chief Engineer, Airships Department, of Vickers Limited, and published by Thomas Nelson and Sons, Ltd., has an interesting discussion on the means used to guide an airship irrespective of weather. The apparatus briefly described, consists of a coil of wire wound on a flat wooden frame—which is rotatable on a vertical axis—and connected with a suitable telephonic receiver. When this coil lies in the plane which passes through a transmitting station, signals from that station are heard with maximum clearness; and when it lies at right angles to that plane, signals are mandible.

The wireless operator rotates the coil until signals are received most powerfully from one of the great land stations, fixes it, and takes its direction by means of a compass. He then moves the coil again and gets the bearings of a second station in like manner. The positions of the two stations—which are identified by "station" signals sent out from time to time—being known, the navigator draws great circle lines on his chart from the stations corresponding to the compass bearings. The intersection of the two lines marks the position, which may be checked by additional bearings.

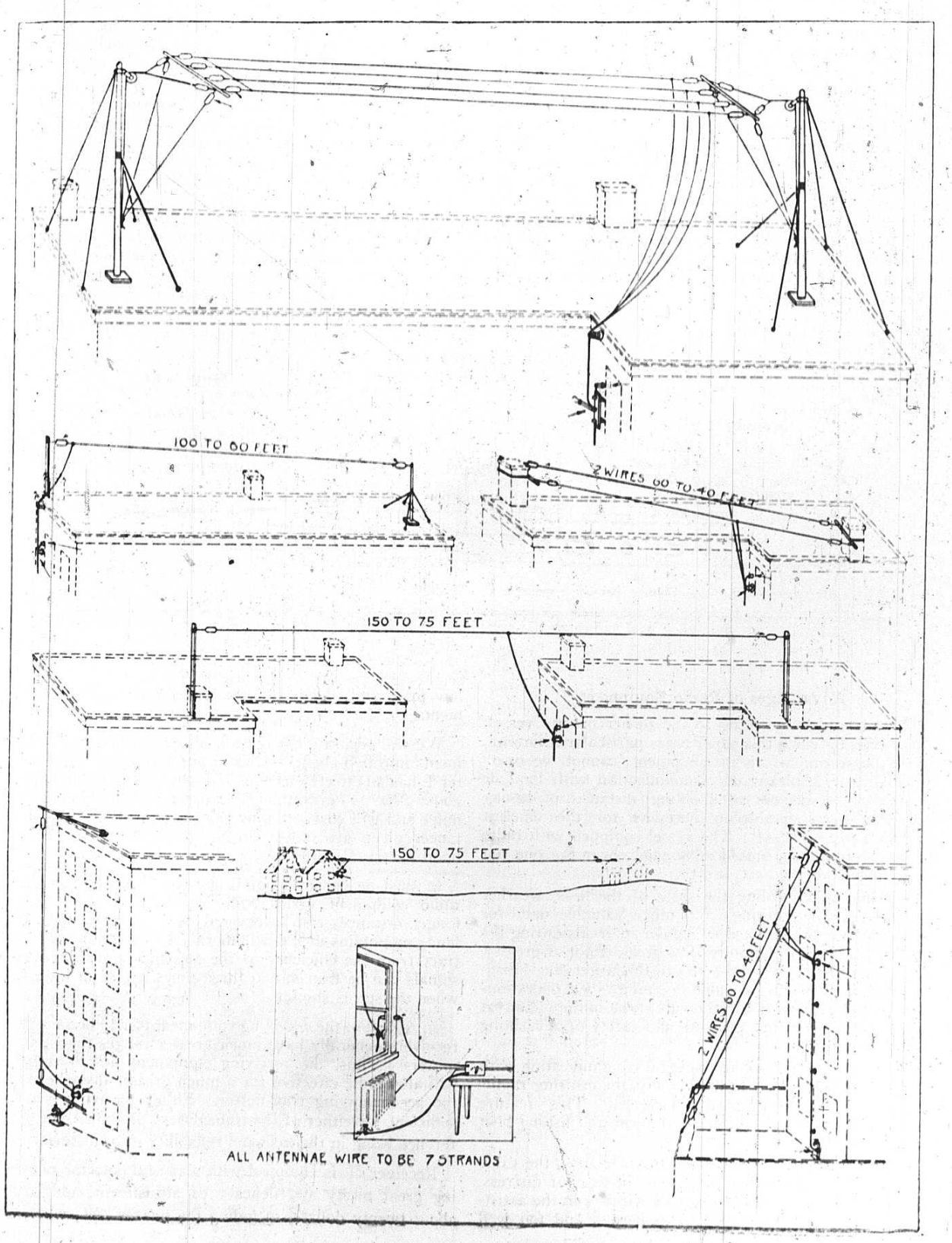
These wireless "fixes" may be plotted as often as desired, and the airship's course be corrected by them.

The system described, invented by Captain Chandler, of the Royal Air Force, is considered a distinct advantage over the Bellini-Tosi system, used by the Germans man system necessitated the fitting of directional receiving apparatus at land stations, whereas, under the Chandler system, it need be on the airship only.

The Chicago Board of Trade now broadcasts radio price quotations every 30 minutes on all business days. The service is proving of great value to middle western farmers, board of trade members say.

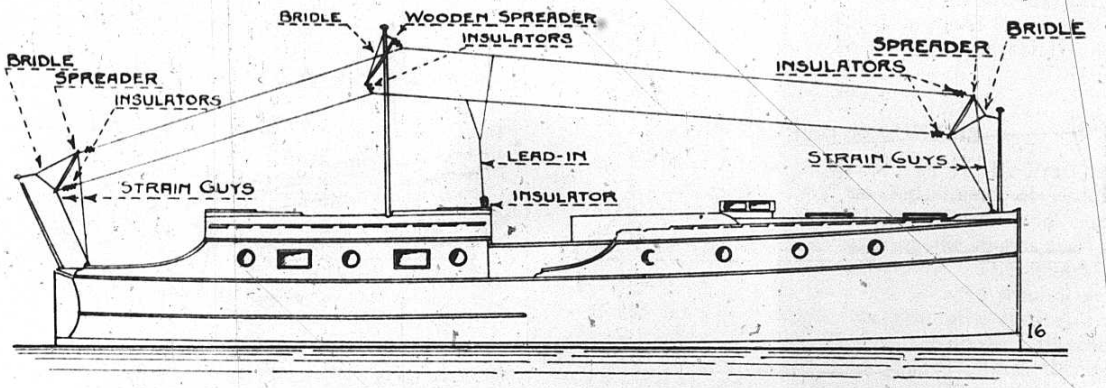
Free medical advice now is being given by radio to ships at sea on both Atlantic and Pacific coasts by the Radio Corporation of America, co-operating with the United States public health service and the Seaman's Church Institute, of New York.

# TYPES of OUTDOOR ANTENNAE



# Radio Equipment for Use on Small Boats

At no time has the question of equipping the yacht, motor boat, fishing vessel, tug or other small craft with a means of wireless communication, either telegraph or telephone, been of greater interest than during the present season. And the erroneous impression has been prevalent that radio equipment is necessarily large and cumbersome, that it is exceedingly expensive and that large powers are required for the operation of the transmitting and receiving apparatus. The small craft—whether of the pleasure or professional type—may be equipped with inexpensive apparatus, especially the receiving equipment, requiring but little space, operated from sources of power available to any boat, and requiring such skill in operation as may be acquired in a short time by any person of average intelligence.




### Advantages of Radio Equipment

The advantages accruing to the owner of any vessel, of the class to which this paper bears particular reference, in the possession of radio equipment cannot be overemphasized. A means of communication with land or with other vessels out of shouting distance is to-day looked upon as an absolute necessity for the efficient operation of any vessel. The vessel equipped with radio apparatus possesses untold advantages over the one not so equipped.

Information regarding the state of the seas, weather forecasts, storm warnings and other valuable data for the mariner is broadcasted at regular intervals during the day, and such information is of as great, if not of greater, importance to the small vessel as to the larger one. Fishing craft, particularly, are able to plan all their operations more effectively with all this up-to-the-minute data at hand; and the comfort, pleasure and safety of a yachting cruise is assured.

Knowing one's ability to maintain communication with land with other vessels in the vicinity, the cruising radius of the small vessel is greatly increased. This feature should be of particular interest to yacht and fishing boat owners.

A most important consideration is, of course, the value of the radio transmitting equipment in case of distress. The instance of the effectiveness of wireless in the assistance of vessels at sea are too numerous and too well known to require repetition at this time; yet one may emphasize the fact that the ability of the small vessel to call for help when in a serious predicament is of incalculable value in the saving of life and property.

### Range and Cost of Apparatus

In considering the matter of apparatus, let us first consider wireless telegraph. Two complete receiving and transmitting equipments will be described. The difference between these sets lies in their effective range and cost, though all the apparatus which will be described can be readily obtained and at a very reasonable cost. It is not suggested that the prospective owner of radio equipment make his own instruments because of the time which is necessarily involved and the special skill required in the construction of such apparatus, and also because of the low price and higher efficiency of the obtainable equipment.

We will separate the receiving and transmitting equipments into two classes—Class I and Class II. Transmitter I. has an effective radius of about fifty miles and costs about $70. Transmitter II. can send about twenty-five miles and will cost in the neighborhood of $30. The distances given are those which can usually be depended upon on the Pacific Coast.

It must be borne in mind, however, that the range of radio equipment varies with local conditions. Thus, longer distances can be covered over sea than over dry land; mountains in the neighborhood of the antennae detract from the efficiency of the apparatus; and normally signals can be transmitted three times as far at night as when the sun is shining.

In regard to the receiving equipment it may be said that receivers generally have much greater ranges than transmitters. Thus, the receiving equipment described here will always be effective for a much greater distance than the accompanying transmitter. Either receiving set is sufficient for either of the transmitters described, the difference being in the ease and reliability of adjustment.

Receiver II. is equipped with a crystal detector requiring great nicety and delicacy of adjustment, and costs about twenty dollars, including the buzzer test; whereas

Receiver I. has a vacuum tube detector which is easily adjusted, is extremely rugged, and the set has a greater range in wave lengths.

The source of power for the transmitter is any good six-volt storage battery, whoch can be obtained at a reasonable price.

A boat equipped with only a receiving set can at least receive messages from shore, can get the news bulletins that are being relayed from various central stations, can get weather reports, listen in on concerts that are given at the broadcasting stations, etc. These sets will also receive wireless telegraphic signals, so that the boat equipped with the receiving apparatus alone, is never wholly out of touch with the shore.

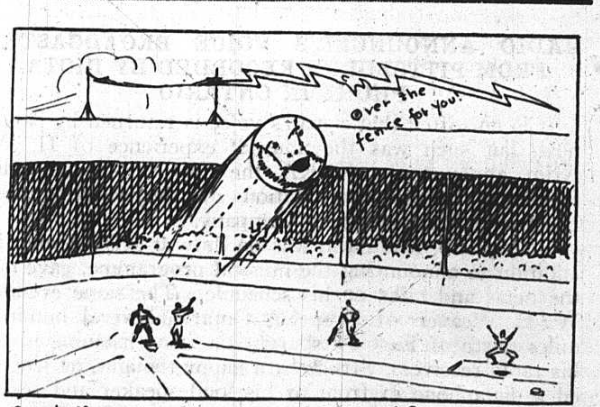
### The Antenna System

The illustration shows how the antenna should be installed on a common type of small vessel. Of course, the type of antenna will vary with the type of the craft upon which it is to be installed, but the prospective owner of radio equipment should have no trouble designing the antenna which will suit his particular requirements from a perusal of the diagram and a consideration of the simple rules underlying antenna design given here.

In form the antenna may consist of one or more—it is usually two, four or six—copper or phosphor-bronze wires separated from each other on a wooden spreader or yard, and supported from any available points above decks in such a manner that they will not be in electrical contact with any portion of the vessel. To accomplish this purpose it is necessary to support the wires by means of insulators—an insulator being a non-conductor of electricity. There are porcelain, glass and composition insulators on the market. The latter, Electrose insulators, are preferable for marine work.

The wire connecting the antenna with the instruments is known as the lead-in. It also must be carefully insulated; and it is brought into the cabin in which the instruments are located through a special lead-in insulator in the deck of a bulkhead.

The ground wire leads from the instrument to a "ground." This may be the hull, if the vessel is of iron or steel or has a copper bottom; it may be any metallic opening into the water from the hull of a wooden vessel; or a sheet of copper may be fastened to the bottom or side of a vessel and a wire led up to the instruments.—*Eugene Dynner in Pacific Motor Boat.*




### THE HIGH-FREQUENCY RESISTANCE OF INDUCTANCE COILS

An "inductance coil" is simply a coil of wire wound in any one of a number of different familiar forms. The behavior of such coils in circuits carrying direct current or alternating currents of low frequencies, such as 60 cycles, has been studied for many years and is well known. When the attempt is made to predict the behavior of an inductance coil at radio frequencies by extending the relations which are sufficient to predict its behavior at low frequencies, it is found that other effects are present at the radio frequencies which do not require consideration at the low frequencies. At low frequencies the same number of amperes flows in every part of the wire constituting the inductance coil, and the distribution of the current over a given cross section is practically uniform. At high frequencies the current density is not uniform over a given cross section of a wire, nor is it the same for different cross sections of the wire. The current flow is modified by induction effects of magnetic as well as electrostatic nature. For direct current the resistance of inductance coils can be determined by Ohm's law, but at radio frequencies Ohm's law by no means gives complete information regarding the resistance of a coil. The study of non-uniformity of current density in a particular cross section is the subject of "skin effect," on which various investigators have already done considerable work. The difference in the current flowing across different cross sections of the wire forming a coil is caused by the capacities distributed along the winding of the coil.

An inductance coil behaves in an electric circuit primarily as an inductance. The potentials of the different parts of the coil are however different from each other and from the potentials of the ground. For this reason the coil behaves also to a certain extent as an electric condenser, or rather a system of condensers. The impedance of these capacity paths is low at radio frequencies, and the capacities constitute shunt paths for the radio-frequency current and cause charges to collect at various points of the coil, thus creating back electromotive forces. There are several effects of the non-uniform distribution of current along the wire, of which the most important is the increase in the resistance of the coil with the frequency. At radio frequencies the resistance of an inductance coil depends upon the point of the coil at which an emf is inserted and the current measured.

On account of the importance of inductance coils in radio communication, careful studies, both theoretical and experimental, have been made at the Bureau of Standards on capacity effects and other effects in inductance coils at radio frequencies. Some of the results of these investigations are contained in a new publication, Bureau of Standards Scientific Paper No. 430, "The High-Frequency Resistance of Inductance Coils," by Gregory Breit. In this paper a formula for the resistance of an inductance coil is derived which takes into consideration both the skin effect and the capacity effect for the case of a short single-layer solenoid, and the results of experiments are given which check this formula. Other more general formulas for current distribution and resistance are also derived. A copy of this paper may be purchased for 5 cents from the Superintendent of Documents, Government Printing Office, Washington, D.C.

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**Broadcasting by radio telephone is destined to have an effect on social and political life comparable to the invention of printing.**

# BROADCASTING NEWS

## Radio Frequency Amplification

The popularity of receiving distant radiophone stations has been increased by the introduction of radiofrequency amplification combined with audiofrequency amplification. Both these terms mean little to the new radiofan, but some day they will find their place in his every day vocabulary, and he will mark himself an up-to-date "Radiofrequencer."

It may be of benefit to state just what the term "audio frequency" means, its use and how it differs from "radio frequency." Audio in its radio application refers to audible sound. For instance the notes on a piano are audible to the ear from the low note to the highest note. But if the piano maker had put more keys on the piano and kept making the notes higher, a point would be reached where the vibration of a particular key would be beyond the sense of hearing.

Thus we have an inaudible sound. Notes that have too high a rate of vibration are beyond the range of our sensitive ear drums. Sounds above the rate of 10,000 vibrations per second are inaudible, but all sounds below this pitch are audible and appear to grow louder as they become deeper in tone.

Illustration of the piano can be applied to radio waves. When they leave the transmitting station they are termed radio frequency currents and cannot be appreciated by the human ear. When a detector or rectifier is introduced into circuit these inaudible radiofrequency currents are lowered and the inaudible high rate of vibration is stepped down and made audible through the diaphragms of the telephone receivers. If the rate of vibration was too high the inertia of the diaphragm of the receiver would prevent its vibrating at such high frequencies.

As long as there are audible currents leaving the detector bulb the audible currents can be stepped up through a transformer and be made louder than ordinarily received on the detector tube. This is done with the aid of the amplifying vacuum tube. This degree of amplification can be carried up to many stages so that the original volume of sound from the first receiver of the detector can be increased thousands of times. But there must be audible currents before the audio amplifier will function. If the detector tube does not respond to certain signals no degree of amplification will make them audible.

With radiofrequency a different condition arises, and radio currents on the aerial that are too feeble to be detected by the detector tube are first amplified one to three stages, but remain in an inaudible condition. However, when they are amplified before they reach the detector the signals of a radiofrequency nature are quite powerful and when finally corrected by the detector tube and reduced they respond with a great volume of audibility.

Now that the currents are audible on the detector tube they can be stepped up by means of audio amplification to any degree. In this manner weak signals that come from a far distant station can be amplified and detected and finally amplified so as to respond with great volume on a loud speaker.

It may also be said that the radiofrequency amplifier whether it be one, two or three stages, does not amplify all little sounds and static and distort the voice, or the music of the radiophone, as with the audio frequency amplifier, but the signals received are clear and of excellent tone quality. Audio amplifiers pick up vibrations and static and tube noises and this is the reason that so many loud speaking devices working on the audiofrequency principle give poor reproduction.

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### WILLIAM JENNINGS BRYAN HAS HIS GREATEST AUDIENCE

William Jennings Bryan, the "Great Commoner," had the largest audience of his long career as a public figure and orator when he spoke recently in Pittsburgh and his address was broadcasted by the Westinghouse Electric & Manufacturing Company.

The "Great Commoner" who, by the marvelous powers of his oratory, has held spellbound thousands of persons, found that his large audiences were greatly exceeded in numbers by the invisible audience which heard his address delivered from the pulpit of the Point Breeze Presbyterian Church, Pittsburgh, Pa. It was reliably estimated that 250,000 persons were in the invisible audience.

The address, one of Mr. Bryan's greatest, was transmitted from the Point Breeze Church by wire to the Westinghouse radio telephone broadcasting station, KDKA, at East Pittsburgh, from where it was broadcatsed.

The oratorical "display" of the "Great Commoner" by radio telephone and the efficient manner in which it was broadcasted by the Westinghouse Company resulted in a deluge of letters to the Westinghouse Company congratulating both Mr. Bryan and the Westinghouse Company for their co-operation in the joint effort which afforded thousands, who otherwise could not have heard Mr. Bryan speak, an opportunity to hear him. More than 4,000 congratulatory letters were received by the Westinghouse Company.

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### RADIO ANNOUNCER'S VOICE BROADCASTED FROM PITTSBURGH RECORDED BY DICTAPHONE IN ONTARIO

It is not often that a man's voice is returned by parcel post, but such was the unusual experience of H. W. Arlin, announcer at KDKA, the East Pittsburgh radio telephone broadcasting station of the Westinghouse Electric & Manufacturing Company.

On April 5, Mr. Arlin was on duty at KDKA and, in addition to announcing the musical programme, gave out the news and talks on his schedule. The same evening W. E. Weaver of Hespeler, Ontario, several hundred miles north of East Pittsburgh, Pa., was listening in on his radio receiver. Struck by a happy thought, he wheeled a dictaphone in front of his loud speaker and registered part of the concert on the record.

This record he sent to the radio department with an

ivvitation to listen to it and see how KDKA is received in Ontario. It is unnecessary to say that everybody connected with the radio division at various times put the head-piece over their ears to hear the canned wireless.

Mr. Arlin was perhaps one of the most interested listeners, for, in addition to hearing the music sent out April 5, his voice registered accurately and clearly each announcement.

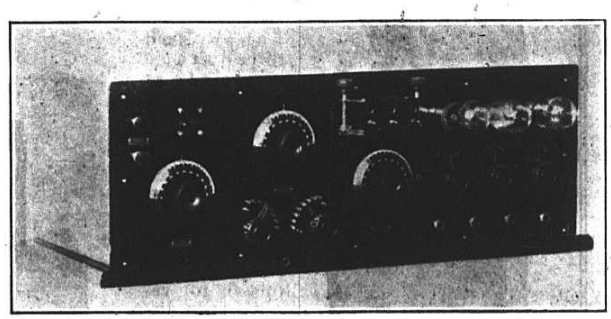
### SHORT AND LONG WAVE REGENERATIVE SET

The set shown in the photograph is a short and long wave regenerative receiver and two-stage amplifier.

When looking at the photo you notice that up in the left hand corner is a handle which controls a six-pole double-throw switch for changing from variometers and variocoupler for short waves to honeycomb coils for long waves.

The variable condensers for the honeycomb coils are mounted on the ends of the variometer shafts. In doing this you save quite a lot of panel space. Therefore, when you are on long waves your variometers are just acting as a through shaft for your condensers. At the rear of the plate variometer is mounted the secondary condenser and grid variometer of your primary condenser.

This set was built by Mr. A. L. Leslie of the Leslie Radio Supply for demonstrating and experimental purposes, and was used at the Ossington Avenue Baptist Church, Toronto, to receive the Toronto Star's Easter concert, sent out by CKCE. Using a magnavox, the music could be heard clearly all over the church.



Mr. Leslie heard in Toronto on this set practically all of the most important American broadcasting stations from Chicago eastwards.

### U. S. WEATHER BUREAU

Owing to lack of space, due to great increase in advertising, it has been necessary to leave over to the June issue the list of distributing stations of U. S. Weather Bureau, which were referred to in our April issue.

# Shielding of Vacuum Tube Receiving Set Solves Problem of Body Capacity Effect

How exasperating it is to have tuned in on a station which appears to be in a distant section of the country, and, as the hands are removed from the dials or knobs to have the station entirely fade away and a loud howling or squealing take its place until the hands are again placed in the same position as formerly. This effect is known as the "body capacity effect" and is caused by the capacity of the body absorbing and detuning the receiving set. The body of a person has a capacity and also stores electrical energy, and when it is brought into proximity with the delicately tuned receiving set, it alters the tuning of a set.

This is not so true of the crystal set as with the vacuum tube regenerative set which has quite an attraction for the absorption of signals by the body. Receiving sets employing variometers and variable condensers show marked decrease of signal strength as the hands approach the dials of the tuning instruments. This strange condition does not occur on well-made commercial sets, and an investigation of the remedies used, indicate that a shield of metal placed between the panel and grounded on the ground binding post of the set will solve the difficulty.

A sheet of metal, either aluminum or copper, or even brass, may be used and must either be cut so as to cover the complete rear of the panel or individual instruments. One concern cuts a sheet of aluminum or copper just a little over the size of the variometer or variable condenser and allowing for the holes for the screws and the shaft of the instrument, covers the rear of the panel so that the sheet is placed between the operator and the instrument. Each piece of apparatus is shielded in this manner and a wire connects to the respective sheets and is grounded.

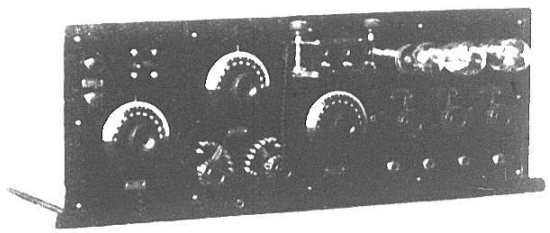
In this manner all body capacity effect is at zero potential, and the dials can be twirled at will without loosing the signals and causing howling in the set. If the dials are metal and connect to the shaft of the instrument, they should be discarded and insulated dials used. It would be useless to shield the set and then bring through the panel the very same current, carrying parts of the set to the outside of the panel, where they could be acted upon by the hands.

If the receiving set is finished in this manner, perhaps many of the good receiving sets that are coupled to two and three steps of amplification will at last pick up the long distant radiophone station that so often has been heard while the operator of the receiver held his breath and kept his body and hands still until the distant station signed off.

The bulbs in a receiving set may also be shielded in this manner if they have a tendency to howl or squeal while in operation. Sheets of copper or brass may be mounted upright between the bulbs or the transformers.

One point that must be remembered in connection with amplifying transformers and two and three stage homemade amplifiers is that the amplifying transformers must be placed so that they are not too close together in the cabinet. If they are too close, the degree of amplification will be lessened, and if space will not permit separating them, it is a good plan to place the cores of the transformers at right angles to each other. This will keep their fields apart and the transformers will have not the least effect upon one another. Transformers that are mounted side by side or adjacent to each other will allow howling to take place, and can only be remedied by inserting a copper shield between them or mounting them so that their iron cores are at right angles to each other.

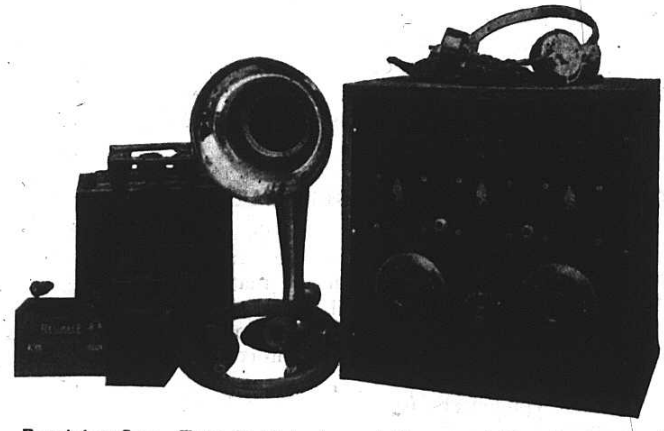
SHORT AND LONG WAVE REGENERATIVE SET



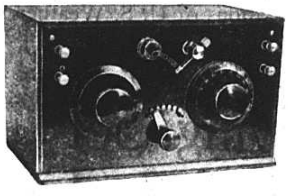
U. S. WEATHER BUREAU

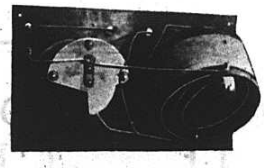
# Shielding of Vacuum Tube Receiving Set Solves Problem of Body Capacity Effect

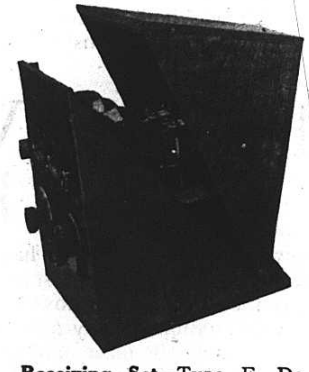
**Receiving Set**—Type J. Detector and Tuner and three stage complete as shown with quarter-cut oak, mission finished phonograph cabinet, loud speaker phone, batteries and aerial and everything complete (less tubes) to receive long distance broadcasting. Panels and sub-panels all drilled and fitted. Knocked down ..$200.00



**Receiving Sets**—Type V. Detector and Tuner and two stage compete as shown with oak, mission finished accessible cabinet, phones, loud speaker, batteries and aerial, and everything complete (less tubes) to receive long distance broadcasting. Panels and sub-panels all drilled and fitted, knocked down—..... $100.00



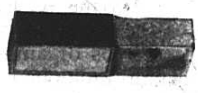




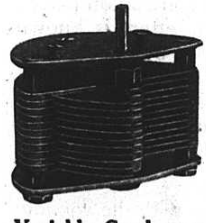
**Crystal Set**—Type B. Crystal Detector set complete as shown with Variocoupler and Variable Condenser tuning, mounted on bakelite in mission finished oak cabinet. Complete to receive local broadcasting (less phones) .....$25.00

(Do not confuse this high class set with many cheap crystal sets as it may be readily converted at any time for long distance receiving, by simply changing wiring and adding a rheostat socket and tube). Music at 800 miles has already been heard on this crystal set. Same as above—knocked down—..... $20.00

**Galena Detector**—All metal parts nickle-plated mounted on bakelite base ..... $2.00



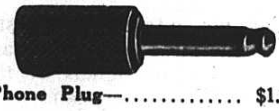
**Galena Crystal**—Tested and packed in cotton and box ..... $ .25



**Variable Condenser**—

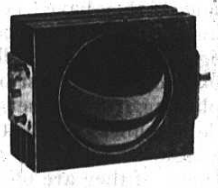
| | |
|---|---|
| 3 plate | .....$2.50 |
| —11 plate | ..... 3.50 |
| —23 plate | ..... 5.00 |
| —43 plate | ..... 6.00 |

**Receiving Set**—Type E. Detector and Tuner and two stage complete as shown with oak, mission finished accessible cabinet (less tubes) for long distance broadcasting. Panels and sub-panels all drilled and fitted, knocked down—.....$50.00



**Phone Plug**—..... $1.25

**Variocoupler** Improved design 85 degrees ..... $5.00



**Variometer**—Improved design ..... $5.00

**Socket**—Nickle-plated metal parts mounted on bakelite base .... $1.00

**Phone Jack**—Single Circuit.. .75

**Phone Jack**—Dble Circuit.. $1.00

# The JACK V. ELLIOT CO. Hamilton Ont.

**Amplifier Transformer**—Thordarson (enough said) ..... $6.50

**Dial**—Handsome and sturdy ..... $1.00

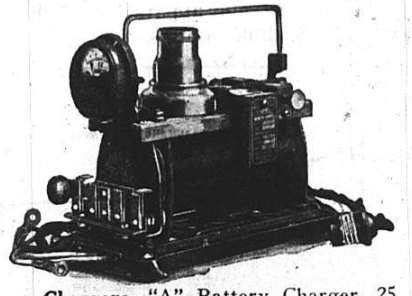
**Rheostat**—Exceptionally smooth adjustment of fialament, with this sturdy rheostat .. $1.40


**Storage Batteries**—"A"—6 volt, 50 amperes ..... $15.00
—"A"—6 volt, 81 ampere ..... 20.00
—"B"—2 volt Cells ..... .50
—"B"—22 volt in carton ..... 5.00
—"B"—22 volt in mahogany case 7.50

**Switch Lever**—Rubber Knob—metal parts, nickle-plated complete with spring and panel adjustable bushing .50
Knob only ..... .10

**Binding Post**—Rubber knob type ... .15
Knob ony ..... .08

**Binding Post**—Nickle-plated ..... .10



**Chargers**—"A" Battery Charger, 25 or 60 cycle ..... $20.00
"A & B" Combined Battery Chargers, 25 or 60 cycle ..... 25.00

**Switch Stop**—Nickle-plated ..... .06

**Switch Point**—$\frac{3}{16}$" face, nickle-plated .04

**Switch Point**—¼" face, nickle-plated .05

**Hydrometers**—Better to know your Battery is up than to be disappointed ..... $1.00

**Phones**—Red Head, 3000 ohms, complete with head bands and cords ..... $12.50

**Head Bands**—All metal, nickle-plated and aluminum, handsome and very light on head ..... $2.00

**Wire,** Antenna, Strand 7—No. 22 Copper, in 2 lb. Coils, per lb. ..... $1.00
**Wire,** Antenna, Strand 7—No. 22 Copper, in 4 lb. Coils, per lb. ..... .95
**Wire,** Antenna, Strand 7—No. 22 Copper, in 100 lb. Coils, per lb. ..... .90
**Wire,** Magnet No. 20 Dble. cotton covered copper, per lb. ..... 1.00
**Wire,** Magnet No. 24 Dble. cotton covered copper, per lb. ..... 1.40
(Magnet wire furnished in ½, 1, 10 lb. Spools)

**Cabinet** furnished in mission oak for 6 x 10 x ⅛ panel ..... 3.00
**Panel Genuine Celeron** 6 x 10 x ⅛ ..... 1.50
**Panel Genuine Celeron** 5 x 7½ x ⅛ ..... 1.00
**Panel Genuine Celeron** 7½ x 12 x ⅛ ..... 2.25
**Panel Genuine Celeron** 7½ x 10 x ⅛ ..... 2.00

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If your dealer cannot supply you send remittance with your order and we will ship you direct.
Prices Subject to Change without Notice.

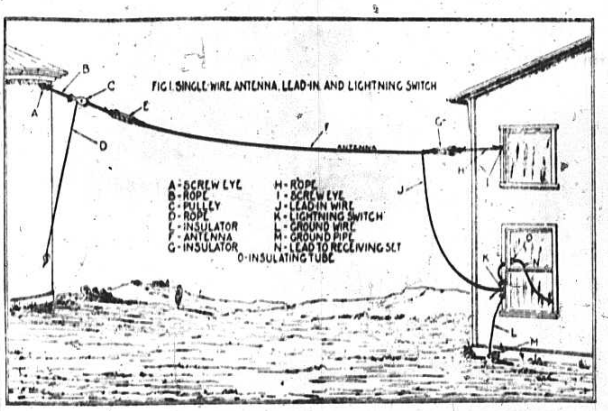
# The JACK V. ELLIOT CO. Hamilton Ont.

# Construction and Operation of a Simple Home-Made Radio Receiving Outfit

Circular No. 120 of the Bureau of Standards describes the construction and operation of a very simple and inexpensive radio receiving outfit. Needless to say such an authoritative article is most welcome after the deluge of unreliable articles bearing on the subject. We feel that the printing of the circular will be generally appreciated by our readers.


## Abstract

The apparatus used for the reception of radio messages may be a home-made affair, very simple and inexpensive, or may be elaborate and expensive. All that is necessary for receiving radio messages is a device for collecting power from the incoming radio waves, a suitable circuit adjusted or "tuned" electrically to the frequency of the incoming waves, and apparatus for changing the received power into audible sounds.


The device for collecting power from the incoming waves is the "antenna." The adjustment of the receiving circuit to the frequency of the incoming waves may be made by a variable inductor or by a variable condenser. In a very simple set it is conveniently made by a variable inductor. The apparatus for changing the received power into audible sounds may consist of a crystal detector, and a telephone receiver specially wound with a large number of turns.

This circular describes the method of constructing in the home a very simple and inexpensive receiving outfit from materials which can be easily secured. The cost of the materials need not exceed $10. Satisfactory results have been obtained from sets constructed according to these instructions by persons having no previous experience with radio.

## Introduction

This circular describes the construction and operation of a very simple and inexpensive radio receiving outfit. The outfit will enable anyone to hear radio code messages or music and voice sent out from medium-power transmitting stations within an area about the size of a large city, and from high-power stations within 50 miles, provided the waves used by the sending stations have wave frequencies between 500 and 1500 kilocycles per second; that is, wave lengths between 600 and 200. This equipment will not receive uninterrupted continuous waves. Occasionally much greater distances can be covered, especially at night. Sets constructed according to these instructions have given clear reception of music transmitted by radiotelephone from stations 300 miles distant. The total cost of the outfit can be kept below $10, or if an especially efficient outfit is desired, the cost may be about $15.

## 2.—Essential Parts of Receiving Station

The five essential parts of the station are the antenna, lightning switch, ground connections, receiving set, and telephone receiver or "phone." The received signals come into the receiving set through the antenna and ground connection. The signals are converted into an electric current in the receiving set and the sound is produced in the phone. Either one telephone receiver or a pair, worn on the head of the listener, is used.

The lightning switch, when closed, protects the receiving set from damage by lightning. It is used to connect the antenna directly to ground when the receiving station is not in use. When the antenna and the connection to the ground are properly made and the lightning switch is closed, the antenna is not a hazard to a building and may act somewhat as a lightning rod to supplement the protection given to a building by lightning rods of standard construction.

The principal part of the station is the "receiving set." In the set described herein it consists of two parts, the "tuning coil" and the "detector," and in more complicated sets still other elements are added.

## 3.—The Antenna, Lightning Switch, and Ground Connection

The antenna is simply a wire suspended between two elevated points. The antenna should not be less than 30 feet above the ground and its length should be about 75 feet (see Fig. 1). This figure indicates a horizontal antenna, but it is not important that the antenna be strictly horizontal. It is in fact desirable to have the end where the pulley is used as high as possible. The "lead-in" wire or drop wire from the antenna itself should run as directly as possible to the lightning switch. If the position of the adjoining building or trees is such that the distance between them is greater than about 85 feet, the antenna can still be held to a 75-foot distance between the insulators by increasing the length of the piece of rope *D* to which the far end of the antenna is attached. The rope *H* tying the antenna insulator to the house should not be lengthened to overcome this difficulty, because by so doing the antenna "lead-in" or drop wire *J* would be lengthened.

(*a*) Details of Parts.—The parts will be mentioned here by reference to the letters appearing in Figs. 1 and 2.

*I* and *I* are screw eyes sufficiently strong to anchor the antenna at the ends.

*B* and *H* are pieces of rope ¼ or ⅜ inch in diameter, just long enough to allow the antenna to swing clear of the two supports.

*D* is a piece of ¼ or ⅜ inch sufficiently long to make the distance between *E* and *G* about 75 feet.

*C* is a single-block pulley which may be used if readily available. The pulley should not allow the rope to catch.

*E* and *G* are two insulators which may be constructed of any dry hardwood of sufficient strength to withstand the strain of the antenna; blocks about ¾ by 1 by 10 inches will serve. The holes should be drilled as shown in Fig. 1, sufficiently far from the ends to give proper

strength. If wood is used, the insulators should be boiled in paraffin. Precautions in regard to melting the paraffin are given in the paragraph under "Accessories." If porcelain insulators are available, they may be substituted for the wood insulators. Porcelain cleats can be used. Regular antenna insulators are available on the market, but the two improvised types mentioned will be satisfactory for an amateur receiving antenna.

*F* is the antenna about 75 feet long between the insulators *E* and *G*. The wire may be No. 14 or 16 copper wire either bare or insulated. The end of the antenna farthest from the receiving set may be secured to the insulator *E* by any satisfactory method, but care should be taken not to kink the wire. Draw the other end of the antenna wire through the insulator *G* to a point where the two insulators are separated by about 75 feet and twist the insulator *G* so as to form an anchor, as shown in Fig. 1. The remainder of the antenna wire *J*, which now constitutes the "lead-in" or drop wire, should be just long enough to reach the lightning switch.

*K* is the lightning switch. For the purpose of a small antenna this switch may be the ordinary porcelain-base, 30-ampere, single-pole double-throw battery switch. These switches as ordinarily available have a porcelain base about 1½ by 4 inches. The "lead-in" wire *J* is attached to this switch at the middle point. The switch blade should always be thrown to the lower clip when the receiving set is not actually being used, and to the upper clip when it is desired to receive signals.

In some stations there is no lightning switch outside the building, but instead a lightning arrester is connected to the antenna lead-in just inside the building; that is, as close as possible to the point where the lead-in leaves the porcelain tube. This lightning arrester has two binding posts, one of which is connected to the antenna lead-in and the other is connected to a suitable ground connection. The type of lightning arrester used should be a protective device approved by the Underwriters Laboratories, Chicago and New York. Information as to the types of devices which are approved may be obtained from the Underwriters Laboratories or from local insurance inspection departments. For the ground connection a water pipe or a steam pipe may be used; a gas pipe should not be used. The use of the lightning switch outside the building as above described is perhaps a little preferable to the use of the lightning arrester inside the building.

*L* is the ground wire for the lightning switch. The ground wire may be a piece of copper wire, No. 14 or larger, and should be of sufficient length to reach from the lower clip of the lightning switch *K* to the clamp on the rod *M*. The use of a large size of copper wire, such as No. 6, or of copper strap, will give added mechanical strength and minimize the danger of accidental breakage of the ground wire.

*M* is a piece of iron pipe or rod driven 3 to 6 feet into the ground, preferably where the ground is moist, and extending a sufficient distance above the ground so that the ground clamp may be fastened to it. The pipe should be free from rust or paint. Special care should be taken to see that the pipe is clean and bright where the ground clamp is connected.

*N* is a wire leading from the upper clip of the lightning switch through the porcelain tube *O* to the receiving set binding post marked "antenna." *O* is a porcelain tube of sufficient length to reach through the window casing or wall. This tube should be mounted in the casing or wall so that it slopes down toward the outside of the building. This is done to keep the rain from following the tube through the wall to the interior.

Fig. 2 shows the radio receiving set installed in some part of the house.

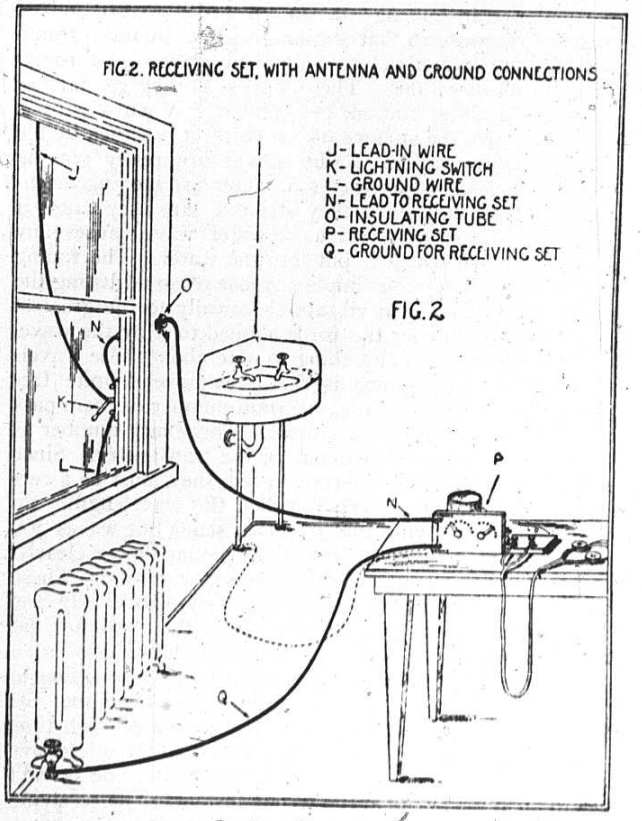
*P* is the receiving set which is described in detail below. *N* is a wire leading from the antenna (upper) binding post of the receiving set through the porceltin tube to the upper clip of the lightning switch. This wire, as well as the wire shown at *Q*, should be insulated and preferably flexible. Unbraided lamp cord will serve for these two leads.

*Q* is a flexible wire leading from the receiving set binding post marked "ground" to a water pipe, heating system, or some other metallic conductor to the ground. If there are no water pipes or radiators in the room in which the receiving set is located, the wire should be run out of doors and connected to a special ground below the window. The ground for the lightning switch should not be used for this purpose. It is essential that for the best operation of the receiving set this ground be of the very best type. If the soil near the house is dry, it will be necessary to drive one or more pipes or rods sufficiently deep to encounter moist earth. The distance between the pipes will ordinarily not exceed 6 feet. Where clay soil is encountered the distance may be 3 feet; in sandy soil it may be 10 feet. Some other metallic conductor, such as the casing of a drilled well, not far from the window will be a satisfactory ground.

### 4.—Tuning Coil, Detector and Phone

The phone and certain parts of the apparatus will have to be purchased. The other parts may be obtained at home.

FIG 2. RECEIVING SET, WITH ANTENNA AND GROUND CONNECTIONS




Continued on page 35

# Helpful Hints on Tuning

BY A. T. VAN DYCK, RADIO ENGINEER OF GENERAL ELECTRIC CO.

The basic rule to be followed for best results in the tuning of a radio receiver, is to understand what each control does, in a general way at least, and to use the controls in systematic, and not hap-hazard, manner. It is not necessary to know the theory of gas engines to operate an automobile, but the driver must know at least what the function of each control is, to drive intelligently, and the more he knows, the better he is able to drive. So with the radio receiver, an understanding of the general principles of the set and its controls, is necessary in order to obtain good results consistently.

In order not to digress from the immediate subject of tuning, I shall have to assume certain things. First, that your apparatus is some good standard make, or, if home-made, is constructed and connected in one of the standard ways. Then I shall assume that your antenna system is properly installed—that the aerial is sufficiently high, not too long or too short, is well insulated and as clear of surrounding buildings and trees as possible, that the ground connection is a good one, and that all electrical joints in the aerial and ground wires are soldered. Then, too, all connections on the apparatus are to be well made and the batteries to be in good condition. In general, one cannot be too careful or too thorough in the installation of a set, if it is expected to be able to operate it day after day without vexatious delays, hunting for troubles and correcting them.

Tuning, in the meaning of this article, is the process of adjustment of receiving apparatus to accord with a particular transmitting station, in order to obtain the greatest response to that station's waves. A radio transmitting station sends electro-magnetic waves out through space in all directions. These waves, as they get farther from the sending station, get weaker. When a wire is elevated above the surface of the earth, it is struck by the passing radio waves. Radio waves are really moving electric forces, just as waves in water are moving mechanical forces, and when they strike a wire they cause it to move, *electrically*, just as a water wave causes any object to move which is put into the water. The tuning of the aerial is for the simple purpose of so adjusting the aerial wire that it can vibrate electrically to the greatest extent possible under the force applied to it by the wave.

There is an important thing to note about these travelling radio waves, which is that they have definite frequency, or, in other words, a certain number of them pass the receiving aerial in a second. The exact number is determined by the adjustment of the transmitter. Since these waves travel at a certain speed, they must be a certain distance apart, which is called the wavelength. So that instead of saying that a station sends out waves 360 metres apart, we could just as well, perhaps more clearly, say that it sends out 830,000 waves per second. These waves strike receiving aerials regularly and evenly one after another, and we want to have them vibrate the aerials as much as possible. Consider the analogy of a rope swing with one boy in it, and another boy trying to swing the first as high as possible. You know that the swing can be started and its motion increased each time it vibrates, even by very weak pushes, if the successive pushes are timed to occur exactly right, and one doesn't try to push the swing at the wrong instant. The receiving aerial works the same way, it corresponding to the swing, and the radio waves to the pushes. The only difference is that in radio instead of changing the rate of the pushes to suit the swing we adjust the length of the swing to suit the pushes. That is, we adjust the electrical length of the antenna to suit the frequency of the waves. Then the antenna will swing electrically as far as it can, depending upon the strength of the wave pushes. Therefore, actual radio receiving sets have to provide some means for changing the electrical length of the antenna. This can be done easily by putting in the circuit some wire wound up into a coil, with some means provided for changing the number of turns which is used, for example by a switch, or with some means for varying the electrical effect of the turns without actually changing the number of them. The variometer is such a means, and is made by having the coil in two parts, one of which turns inside the other. Also it is found that if there are connected in the circuit two metal plates which are placed near to each other but not touching, and one of them is moved, that this changes the electrical length of the circuit. Such a device is called a variable condenser. Sometimes both condenser and adjustable coil, called variable inductance, are used.

There are two somewhat different ways of connecting up the tuning devices, which are in common use to-day. These are known as the single circuit tuner and the two circuit tuner. In the operation of a receiver based on either one of these tuning systems, adjustment of the tuner part is but half the problem. In addition to the tuning system, there is the detector, which is connected to the tuning part, and which changes the received high frequency current into one with a form which will operate telephone receivers—as the high frequency current itself cannot. There are two kinds of detectors in common use to-day—the crystal, or mineral detector, and the vacuum tube detector. So that there are four fundamental combinations in making a set: first, the single circuit crystal type; second, the two circuit crystal type; third, the single circuit vacuum tube type, and last the two circuit vacuum tube type.

The single circuit crystal receiver is of course the simplest to operate. In this there are only the tuning control and the crystal. The proper procedure in tuning this type is to set the detector in contact and slowly vary the tuning control until desired signals are heard, then adjust tuning and detector contact to maximum results. The most difficult part of this process is that if no signals are heard at first, it is impossible to tell whether the detector is in receptive condition or not. It is possible and very desirable to connect up a doorbell buzzer, a push button and a single dry cell battery so as to test the detector and set it in sensitive condition. Ways of doing this are shown in most radio text books. Also it very often happens in a house equipped with electric lights that the switching on or off of a lamp makes enough electrical disturbance to hear on the radio receiver as a sharp click. This click is not heard if the detector is not in sensitive adjustment, so that the detector can be adjusted while some switch is being turned on and off until the clicks are heard most loudly.

Now, just a word about the operation of detector vacuum tubes. Assuming that the proper accessories are used and are properly connected up, the adjustment of

the tube to sensitive condition is done on most sets entirely by the filament rheostat, which controls the current through the filament, and therefore its temperature. Usually the tube will operate to some degree if the filament temperature is anywhere near right, but best signals will be obtained only after it is exactly right, which is accomplished after signals have been picked up. The filament must not be burned brighter than necessary. If it is, its life will be greatly shortened. The correct brilliancy is one not quite as bright as the ordinary incandescent lamp filament, and care should be taken always to burn the filaments as dimly as possible.

Most sets using vacuum tube detectors have another feature added in connection with the tuner which is valuable. This feature is called regeneration, and is valuable because it adds to the sensitiveness of the set enormously. It consists usually of a coil whose electrical relation to the tuning coil can be adjusted. This coil is called the tickler coil, or the intensity coil, or the regeneration coil. When this is provided on a receiver, it gives one more adjustment to be made. Consider a single circuit receiver using vacuum tube and regeneration. We have three controls, the wavelength tuning, the regenerative coil, and the filamen rheostat. The proper method of procedure in operation is as follows. Set the filament to as near proper brilliancy as it is possible to estimate. On many tubes this point is easily found—the tickler coil being set at zero during this adjustment—by increasing the brilliancy slowly until a hissing sound is heard in the telephones, and then decreased just enough to stop the hissing. The next step is to vary the wavelength control over its range very slowly, listening carefully for the desired signals. When they are heard, adjust the wavelength control and the filament control to best results and then increase the regenerative or tickler control until signals are best, possibly slightly readjusting the wavelength control, which may be affected by the change of the tickler. If the tickler is increased too far, telephone signals will be spoiled, speech and music sounding mushy instead of being clear. Always take pains not to increase the tickler too far, because when this is done, the vacuum tube oscillates, or becomes a small generator of high frequency current, and this current goes out on the aerial and causes waves just like a sending station's, only not as powerful, and other receiving stations within a distance of one or two miles can hear it and will be interfered with by it. Whenever you hear on your set some whistling sounds which come and go, varying in pitch, you may know that some receiving stations near you are radiating in this way because their ticklers are turned up too far. This is an excellent opportunity for practicing the Golden Rule—remember that whenever your tickler is increased too far, you are causing to other stations the same interference which they cause you. Every man on his own tickler guard!

The single circuit receiver with its few controls, is quite simple to operate, and a little experience enables one to get results easily. This type of receiver is sensitive, but is not as selective as the two circuit type, that is, it is more likely to let through undesired signals with the desired ones, thereby interfering with the desired signals. On the other hand, the two circuit receiver, especially if provided with regeneration, is much more difficult to adjust. The major controls on a two circuit receiver are the aerial circuit—called primary—tuning, the secondary circuit tuning, the coupling between these two, the tickler, and the tube filament rheostat. In short, there are five controls to adjust. The most important, and most critical one of these is the secondary tuning. To pick up signals, set the coupling at or near maximum, the detector filament brilliancy properly, the primary tuning control at or near its lowest value, and the tickler at or near its lowest value. Then very slowly vary the secondary wavelength control from zero to maximum. If signals are not heard, change the primary setting five or ten degrees and vary the secondary through its range again. This should be continued until signals are heard. If they are not heard, increase the tickler some and repeat. After a signal is once located, adjust all controls to best results, remembering that if it is desired to obtain selectivity, that is, freedom from interference, the coupling must be decreased toward zero considerably. Do it in small steps so as not to lose the signal at any time. The tickler may be increased to best position, but not so far as to oscillate the tube, since this spoils the signals and causes the same trouble to other receiving stations that it does on the single circuit receiver as mentioned above. The decrease in coupling will decrease the strength of the desired signals, too, but not as much as the undesired ones.

## CANDIDATES SUCCESSFUL IN EXAMINATIONS

The Department of the Naval Service announce that eighteen candidates were examined during the month of April, 1922, of which the following were successful and obtained Certificate of Proficiency in Radiotelegraphy:

### 1st Class (Commercial)

S. R. Ballam, St. Johns, Nfld.
W. F. Barrett, St. Johns, Nfld.
V. W. Irish, Mulgrave, N.S.
J. M. Kyle, Victoria, B.C.
F. J. Lewis, St. Johns, Nfld.
L. F. Newell, Bareneed, Nfld.
W. J. Scanlan, Melrose, Trinity Bay, Nfld.
R. M. Turner, Troon, Ayr, Scotland.

### 2nd Class (Commercial)

D. M. Galt, Montreal, P.Q.

Next season we may see the following advertisement in newspapers:—"Wanted, men for logging camp in Northern Quebec. Best of wages and living conditions. All camps belonging to this company are fully equipped with wireless receiving sets, including magnavox. Concerts and news of the outer world received in all bunk-houses. Apply——." The prairie farmer will also have an additional argument with which to persuade his hired man to remain over the winter.

# RADIO TRADE REVIEW

## WHAT TO STOCK

The question foremost in the retailers' mind to-day is "What shall my initial radio stock consist of?" The average dealer does not like to put a large amount into an untried field of this kind, and his attitude is entirely justified. He should choose his first stock with care.

First, it is safe to say that only receiving equipment should be considered at present. It is only this apparatus that broadcasting has created such a demand for, and the wise merchant realizing this, is immediately able to place more on his shelves than his customers will want, without increasing his radio budget. He also profits more on every sale due to the great turnover with the smallest amount of capital tied up in stock.

This receiving equipment can be obtained as complete sets or as separate parts with which to construct sets. The big demand is for the complete sets, and the dealers that profit most is the one that makes his supply follow closest to the demand. The apparatus your customer will buy depends on two local conditions.

1. Your geographical position with respect to a broadcasting station.
2. Your type of customer.

If you are close to a broadcasting station (within 50 miles) it is possible to have satisfactory reception with an inexpensive set. If, on the other hand, your customers are of the type that are willing to spend more to get better results—if they want to hear other stations—get news and programme from distant cities—you will be able to sell the more expensive equipment. If you are further than fifty miles from a station results are satisfactory only with a vacuum type of detector.

The inexpensive outfit (good within fifty miles of sending station) consists of the following parts:

| Name of part | Approximate retail cost |
|---|---|
| 1. Crystal detector | $ 2.00 |
| 2. Vario-coupler | 10.00 |
| 3. Variable condenser | 6.75 |

If, however, the instruments you sell are to receive from stations over fifty miles away, the following are necessary:

| | |
|---|---|
| 1. Vacuum tube detector | $10.00 |
| 2. Two variometers | 20.00 |
| 3. Vario-couplers | 10.00 |
| 4. "B" battery | 2.50 |
| 5. Telephone headset | 10.00 |

The first three items of the first list are combined in a cabinet and sell as a complete set ready to attach to the aerial and ground phones. This retails at about $35.00. The first three items of the second list are also combined in a cabinet by several manufacturers as a complete set ready to attach to the other items mentioned in the list plus the aerial and the ground. This type retails at about $80.00. If the incoming signals are desired through a loud speaking apparatus so that a group may hear (an ideal arrangement for demonstrating in your store) a two step amplifier is needed in conjunction with the apparatus in this second list and the loud speaker. The amplifier sells in the neighborhood of $70.00 and the loud speaker from $25.00 to $110.00.

The safest way to enter the radio game, like any other, is to carefully feel your way, analyzing conditions at every step. A good plan is to buy one of each of the two sets described. Erect an aerial of one wire 100 feet long at least fifty feet from the ground, and have both sets in full operation in your store. Get the news, lectures, reports, programmes, etc.—advertise the fact and your store will always be crowded with people buying every line you carry—not only radio supplies. You will be able to take orders for these sets and do considerable business without incurring much risk or loss.

There is, however, a warning to be sounded for retailers. Watch your stock carefully! Remember—that at this time, immediately following one of the worst depressions in years, there are hundreds of factories idle that are very capable of making first class radio apparatus. Skilled labor can be had for 35 to 40 cents an hour, and with these conditions existing a flood of production is sure to follow this terrific demand now existing. The price of radio equipment should be considerably lower in ninety days. Do not overstock!

Furthermore, developments in radio are so rapid that great caution should be taken to make sure that your shelves will never be found with apparatus for which there is no demand. There are at present in the laboratories of some of the larger manufacturing companies working models of new radio equipment of such radical improvement that its introduction will render the apparatus it displaces obsolete. To be caught with a large stock of the latter will mean a considerable loss to you. Watch your step.—*"Electrical Retailing."*

## EQUIPMENT FOR COUNTRY DEALERS

The town or country dealers who intend to sell radio equipment should, first, fully decide on the equipment necessary for their town. The salesman will be a big help in this. Some equipments are not strong enough to receive messages from a distance of over twenty-five miles, while others have an unlimited range. For towns that are farther than twenty-five miles from a broadcasting station, the latter class is, of course, necessary to clear receiving.

## ATTRACTING CUSTOMERS

There are many means of attracting customers. Dealers who have outfits in their stores give radio concerts, entertain customers, or keep a weather bulletin, or a clock with the standard time as received by radio.

## RADIO FOR FLYING BOATS

A letter from the Aeromarine Plane and Motor Company states that they are anxious to get in touch with some firm of radio manufacturers with a view to equipping their large F-5-L flying boats with the proper wireless outfits. The editor will be pleased to furnish their address upon request.

## THE LATEST IN LOUD SPEAKERS: THE BRISTOL AUDIOPHONE

Elsewhere in this issue is found an announcement regarding the new loud speaker made by the famous Bristol Company. The advent of this company into the Radio field will be hailed with pleasure, particularly by those who have known or used the Bristol line of meters, graphic recorders, and other laboratory appliances.

We had the pleasure of listening to a demonstration of this instrument recently. The absolutely faithful reproduction and surprising volume of the signals from broadcasting station WGY, gave us a new angle on the value of loud speakers in radio reception.

With a single detector bulb, using 3 stages of power amplification, and a Bristol Loud Speaker, we were able to fill a large room with the music from WGY. Increasing the volume by amplification does not cause the distortion that is present in all the other types of loud speakers we have heard. Considering that WGY is distant some 300 miles from Toronto, we think it quite remarkable that the voice of the announcer at WGY was projected through the Bristol Audiophone into our wireless room with a loudness about five times as great as that of the WGY operator's own voice. In fact, it was so loud that we had to cut down the strength for comfort. Yet even at the loudest adjustment every word was clear.

One welcome feature of the Audiophone is the absence of those harsh static cracks and crashes. Not that the Audiophone eliminates static, it however reproduces it more softly and so gives a better signal-to-static ratio.

On top of all this, the Audiophone requires no external field current, and so is connected with the amplifier just where the head receivers would ordinarily go.

The horn on the Audiophone is unique, being partly a smooth aluminum casting, and terminating with a spun aluminum flare. The housings of the reproducer and transformer are of die cast aluminum, the transformer housing also doing duty as a base for the instrument.

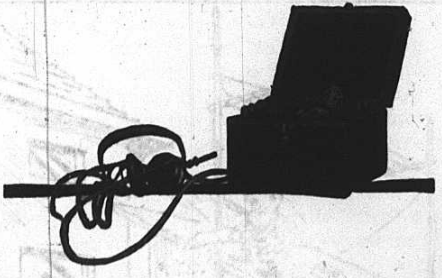
The whole affair is finished in bronze laquer and presents an appearance in keeping with the most elaborate and costly parlor equipment.

Messrs. A. H. Winter-Joyner Limited, 62 Front St. West, Toronto, are Canadian distributors for this device.

## NEW APPARATUS FOR RADIO RECEPTION PRODUCED BY WESTINGHOUSE COMPANY OF EAST PITTSBURGH

Another step in the advancement in radio reception has been made through the invention and manufacture of new apparatus by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., whose nightly programmes from its radio telephone broadcasting station, KDKA, are heard by thousands of radio enthusiasts.

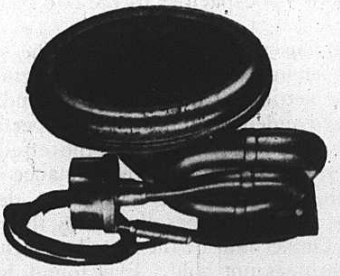
The new products are the Aeriola, Sr., and the Vocarola. The former is a regenerative receiver and the Vocarola is a reproducing apparatus which serves the purpose of a sound chamber. Through the use of the new apparatus, reception of programmes broadcasted by radio telephone will be made comparatively easy.



The Aeriola, Sr., is a single circuit tube regenerative receiver. It is contained in a nicely finished wood box with a cover and, as supplied, includes a Brandes head set and special type WD-11 Vacuum Tube.

The oscillating circuit of the receiver of the Aeriola, Sr., is identical with that of the Aeriola, Jr. It consists of a mica condenser of two steps in series with a variometer inductance. The steps of condenser are brought out to two binding posts, the lower capacity being used for wave lengths up to 350 meters, and the higher capacity for wave lengths ranging from 300 to 500 meters. Tuning in between these steps is accomplished by the variometer inductance.

The feed-back circuit consists of a variometer inductively coupled with the antenna oscillating inductance. A part of the tickler winding is wound on the same tube that carries the antenna inductance and the remainder of the winding is contained on a tube which rotates within the



stationary tube. Complete control of the regeneration at all wave lengths is effectively accomplished and the circuits are so designed that the amount of regeneration is practically constant for any setting of the tickler throughout the range of wave lengths of the receiver.

A special tube is furnished with the Aeriola, Sr., the filament of which will operate from a single 1½ volt dry battery. A rheostat takes care of the variation in battery voltage. The tube requires but 22.5 volts plate voltage. It is provided with a special base to preclude the possibility of any one inserting it in a socket intended for a tube of higher voltage.

The Vocarola consists of a specially designed metal horn mechanically attached to the mechanism of a single Baldwin telephone receiver. The standard Baldwin mica diaphragm has been replaced by a special metal diaphragm which will stand practically any amount of abuse without damage. A large amount of experimental work was carried on by Westinghouse radio experts before final decision was made on the horn, and it is believed that the design furnishes as fine a quality of reproduction as can be obtained except through the use of a very elaborate sound chamber, such as is found in high-priced talking machines.

The Vocarola will work satisfactorily from a two-stage audio frequency amplifier and, using good amplifying tubes, 150 to 200 volts may be used without damage to the instrument.

Continued from page 29

(*a*) TUNING COIL (*R*, Fig. 3).—This is a length of cardboard tubing with copper wire wound around it. The cardboard tubing may be an oatmeal box. Its construction is described in detail below. A cylinder of wood or other non-metallic substance may also be used.

(*a*) CRYSTAL DETECTOR (*S*, Fig. 3).—The crystal detector may be of very simple construction. A number of different kinds of crystals are suitable for use as detectors; these are discussed in detail in the book "The Principles Underlying Radio Communication." A galena crystal which will be satisfactory can usually be conveniently secured. Silicon is usually not as sensitive as galena, but is sometimes more easily obtained, and sensitive spots are often more easily located on silicon. It is important that a selected tested crystal be used.

The crystal detector can be made up of the tested crystal, three wood screws, a short piece of No. 16 copper wire or a nail, a piece of fine copper wire such as No. 28 or 30, a set screw type binding post and a wood knob or cork.

The crystal may be held in place on the wood base by three brass wood screws, as shown at 1, Fig. 3. A bare copper wire is wrapped tightly around the three brass screws for connection.

A metal called "Wood's Metal," which has so low a melting point that it will melt in boiling water, may be purchased in many stores. If this metal is available, it may be used for mounting the crystal, but a metal of higher melting point, such as ordinary solder, should not be used because it may seriously injure the crystal. A shallow hole of size suitable to hold the crystal and leave most of the crystal projecting may be bored in the wooden base, and melted Wood's metal poured into the hole so that the crystal is held in place. The wire which is to make connection with the crystal should terminate in the hole so that it will be embedded in the Wood's metal. Instead of being mounted in a hole bored in the base, the crystal may be mounted in a small brass cup such as is found on the positive terminal of some kinds of dry batteries.

The binding post may be mounted on the back of the upright panel near its edge, as shown in Fig. 4. It may be found more convenient to mount the binding post on a small vertical piece of wood screwed to the base at another point, so that the detector will be more accessible. A long slender nail, or a piece of copper wire of such size as No. 16, about 2 inches long, is bent as shown about ½ inch from one end, with an offset depending on the size of the crystal used. Ordinarily the offset may be about ¼ inch. This nail or piece of wire is inserted in the binding post as shown. To the upper end of a small cork or wooden knob is attached. To the lower end a short piece of fine copper or brass wire is attached and the free part of the wire is wound into a small spiral of several turns. For this fine wire it will be found best to use No. 26, No. 28, or No. 30. For galena the smaller wire such as No. 30 will usually be found best.

(*c*) PHONE (*T*, Fig. 3).—It is desirable to use a pair of telephone receivers connected by a head band, usually called a double telephone head set. The telephone receivers may be any of the standard commercial makes having a resistance of between 2,000 and 3,000 ohms. The double telephone receivers may cost more than all the other parts of the station combined, but it is desirable to get them, especially if it is planned to improve the reeciving set later. A single 1,000-ohm telephone receiver with a head band may be used but with less satisfactory results.

(*d*) ACCESSORIES.—Under the heading of accessory equipment may be listed binding posts, switch arms, switch contacts, test buzzer, dry battery, and boards on which to mount the complete apparatus. The binding posts, switch arms and switch contacts may be purchased from dealers who handle such goods, or they may be readily improvised at home. The pieces of wood on which the equipment is mounted may be obtained from a dry packing box and covered with paraffin to keep out moisture. Care should be taken in melting the paraffin not to get it too hot. For this reason, it is a good plan to melt it in a pan set in boiling water. When the paraffin just begins to smoke it is at the proper temperature. When the wood parts have been drilled and cut to size, they should be soaked in the melted paraffin, or the paraffin may be applied quickly with a small brush. When cold, the excess paraffin must be carefully scraped off with a straight piece of metal such as the brass strip in the edge of a ruler.

### 5.—Details of Construction

The following is a description of the method of winding the tuning coil and the construction of the wood panels:—

(*a*) TUNING COIL (*R*, Fig. 3).—The cardboard tubing is 4 inches in diameter by 4½ inches long. One end of the tube should have the cardboard cover glued securely to it. About 2 ounces of No. 24 (or No. 26) double cotton-covered copper wire is used for winding the coil. Punch three holes in the tube ½ inch from one end, as shown at 2 in Fig. 3. Weave the wire through these holes in such a way that the end of the wire will be firmly anchored, leaving about 12 inches of the wire free for connecting. Start with the remainder of the wire to wind the turns in a single layer about the tube, tightly and closely together. After 10 complete turns have been wound on the tube hold these turns tight and take off a tap. This tap is made by twisting a 6-inch loop of the wire together at such a place that it will be slightly staggered from the first connection. This method of taking off taps is shown clearly at *U*, Fig. 3. Proceed in this manner until 7 twisted taps have been taken off—one at every 10 turns. After these first 70 turns have been wound on the tube, take off a 6-inch twisted tap for every succeeding single turn until 10 additional turns have been wound on the tube. After winding the last turn of wire, anchor the end by weaving it through two holes punched in the tube as at the start, leaving about 12 inches of wire free for connection. It is to be understood that each of the 18 taps is slightly staggered from the one just above, so that the taps will be punched along one line on the cardboard tube (see Fig. 3). It might be advisable, after winding the tuning coil, to dip the tuner in hot paraffin. This will help to exclude moisture. It is important to have the paraffin heated until it just begins to smoke, as previously explained, so that when the tuner is removed it will have only a very thin coat of paraffin.

(*b*) UPRIGHT PANEL AND BASE.—Having completed the tuning coil, set it aside and construct the upright panel shown in Fig. 4. This panel may be a piece of wood approximately ½ inch thick, 4½ inches wide, and 8 inches long. This panel can be used with apparatus to be described in another publication. For this reason it is desirable to have the last contact an inch from the right end of the panel (see Fig. 4). It is also desirable to have the contact points near the top of the panel. The position of the several holes for the binding posts, switch arms, and switch contacts may first be laid out and drilled. The antenna and ground binding posts may be ordinary 8/32

brass machine screws about 1½ inches long with three nuts and two washers. Th efirst nut binds the bolt to the panel, the second nut holds one of the short pieces of stiff wire, while the third nut holds the antenna or ground wire, as the case may be. The switch arm with knob shown at *V*, Fig. 3, may be purchased in the assembled form or it may be constructed from a ⅜-inch slice cut from a broom handle and a bolt of sufficient length equipped with four nuts and two washers, together with a strip of thin brass somewhat as shown. The end of the switch arm should be wide enough so that it will not drop between the contact points, but not so wide that it can not be set to touch only a single contact. The switch contacts (*W*, Fig. 3) may be of the regular type furnished for this purpose, or they may be 6/32 brass machine screws with one nut and one washer each; they may even be nails driven through the panel with the individual tap fastened under the head or soldered to the projection of the nail through the panel. The base is of wood approximately ¾ inch thick, 5½ inches wide, and 10½ inches long.

The telephone binding posts should preferably be of the set-screw type as shown at *X*, Fig. 3.

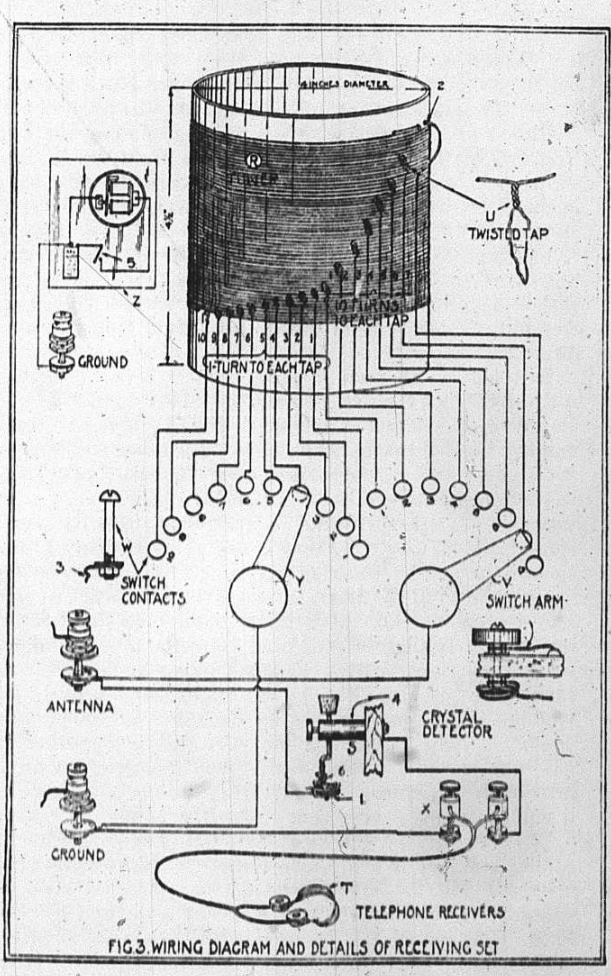



FIG 3. WIRING DIAGRAM AND DETAILS OF RECEIVING SET

## 6.—Instructions for Wiring

After the several parts mentioned have been constructed and (with the exception of the tuning coil) mounted on the wood base, the wires may be connected to the switch arms and binding posts, and the taps may then be connected to the switch contacts. A wire is connected to the back of the left-hand switch-arm bolt (*Y*, Fig. 3), twisted into a spiral of one or two turns like a clock spring, and then led to the back of the binding post marked "ground." Connection is made to the binding post by removing the insulation from the wire and clamping between the nut and washer. The same wire is now passed through a small hole and run underneath the base to the left-hand binding post marked "phone." A wire is then run from underneath the right-hand binding post marked "phone" to the binding post *4*, Fig. 3, which is part of the crystal detector. The copper wire, which was wrapped tightly about the three brass wood screws that hold the crystal in place, is led underneath the base, up through a small hole, and is then connected to the back of the binding post marked "antenna." Another wire is connected to the back of the right-hand switch-arm bolt (*V*), twisted into a spiral of one or two turns like a clock spring, and then connected to the back of the same binding post.

The taps leading from the tuner should now be connected to the switch contacts. Scrape the copper insulation from the loop ends of the 16 twisted taps as well as from the ends of the two single wire taps coming from the first and last turns. Fasten the bare ends of these wires to the proper switch contacts as shown by the corresponding numbers in Fig. 3. Be careful not to cut or break any of the looped taps. The connecting wires may be fastened to the switch contacts by binding them between the washer and the nut as shown at *3*, Fig. 3. After all the wires from the tuner have been connected, the tuner should be fastened to the base by two or three small screws passing through the card-board end. The screws should be provided with washers.

## 7.—Directions for Operating

After all the parts of this crystal-detector radio receiving set have been constructed and assembled, the first essential operation is to adjust the fine wire so that it rests on a sensitive point on the crystal. This may be accomplished in several ways; one method is to use a buzzer transmitter. Assuming that the most sensitive point on the crystal has been found by the method described in paragraph below, "The Test Buzzer," the rest of the operation is to adjust the radio receiving set to resonance or in tune with the station from which the messages are sent. The tuning of the receiving set is accomplished by adjusting the inductance of the tuner. That is, one or both of the switch arms are rotated until the proper number of turns of wire of the tuner are made a part of the metallic circuit between the antenna and ground, so that together with the capacity of the antenna the receiving circuit is in resonance with the particular transmitting station. It will be remembered that there are 10 turns of wire between adjacent contacts of the 8-point switch and only 1 turn of wire between adjacent contacts of the 10-point switch. The tuning of the receiving set is best accomplished by setting the right-hand switch arm on contact (1) and rotating the left-hand switch arm over all its contacts. If the desired signals ar enot heard, move the right-hand switch arm to contact (2) and again rotate the left-hand switch arm throughout its range. Proceed in this manner until the desired signals are heard.

It will be advantageous to know the wave frequencies (wave lengths) used by the radio transmitting stations in the immediate vicinity. A lower frequency (greater wave length) requires more turns of the coil.

(*a*) The Test Buzzer (*Z*, Fig. 3).—As stated, the more sensitive spots on the crystal can be found by using a test buzzer. The test buzzer is used as a miniature local transmitting set. This is shown at *Z*, Fig. 3. The

buzzer, dry battery, and switch (*5*) may be mounted on the table or a separate board. The binding post marked "ground" may be one terminal of the dry cell. The current produced by the buzzer will be converted into sound by the telephone receivers and the crystal, the loudness of the sound depending on what part of the crystal is in contact with the fine wire. To find the most sensitive spot, connect the binding post marked "ground" of the receiving set to the test buzzer binding post marked "ground," close to the switch (*5*, Fig. 3), and if necessary adjust the buzzer so that a clear note is emitted; set the right-switch arm on contact point No. 8 and connect the

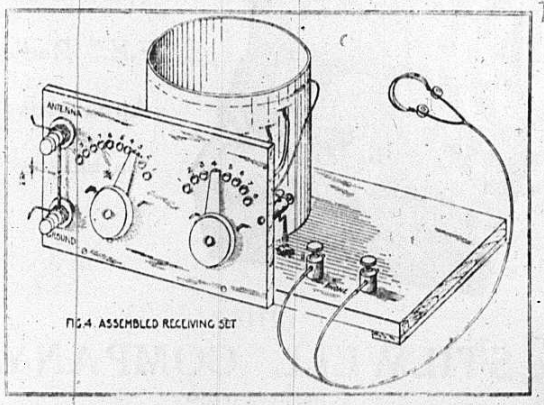


FIG.4. ASSEMBLED RECEIVING SET

telephone receivers to the binding posts. Loosen the set screw of the binding post (*4*) slightly and change the position of the fine wire (*6*, Fig. 3) to several positions of contact with the crystal until the loudest sound is heard in the phones; then slightly tighten the binding post set screw (*4*). The single wire connection between the test buzzer and the receiving set is all that is necessary to give a good test signal when the crystal detector is adjusted to a sensitive spot.

After the construction of the set has been completed, a test should be made for broken wires or poor contacts. Connect one terminal of the dry battery to the binding post marked "antenna." Connect the other battery terminal to one terminal of the buzzer, and from the other buzzer terminal run a wire to the binding post marked "ground." Turn the left-hand switch arm to the extreme left and the right-hand switch arm to the extreme right. If the buzzer operates, the metallic circuit of the coil is complete.

To make sure that the cords of the telephone receiver are all right, put the telephone receivers over the ears and touch the two cord tips to the two terminals of the dry battery. If a click is heard in both receivers, the cord is all right.

### 8.—Approximate Cost of Parts

The following list shows the approximate cost of the parts used in the construction of the receiving station. The total cost will depend largely on the kind of apparatus purchased and on the number of parts constructed at home.

| | |
|---|---|
| Antenna: | |
| Wire, copper, bare or insulated, No. 14 or 16, 100 to 150 feet | $0.75 |
| Rope, ¼ or ⅜ inch, 2 cents per foot. | |
| 2 insulators, porcelain | .20 |
| 1 pulley | .15 |
| Lightning switch, 30-ampere battery switch | .30 |
| 1 porcelain tube | .10 |
| Ground connections: | |
| Wire (same kind as antenna wire). | |
| 2 clamps | .30 |
| 1 iron pipe or rod | .25 |
| Receiving set: | |
| 3 oz. No. 24 copper wire, double cotton covered | .75 |
| 1 round cardboard box. | |
| 2 switch knobs and blades complete | 1.00 |
| 18 switch contacts and nuts | .75 |
| 3 binding posts, set screw type | .45 |
| 2 binding posts, any type | .30 |
| 1 crystal, tested | .25 |
| 3 wood screws, brass, ¾ inch long | .03 |
| 2 wood screws for fastening panel to base | .02 |
| Wood for panels (from packing box). | |
| 2 pounds paraffin | .30 |
| Lamp cord, 2 or 3 cents per foot. | |
| Test buzzer | .50 |
| Dry battery | .30 |
| Telephone receivers | 4.00 |
| Total | $10.70 |

If the switches are constructed as directed and a single telephone receiver be used, the cost may be kept well below $10.

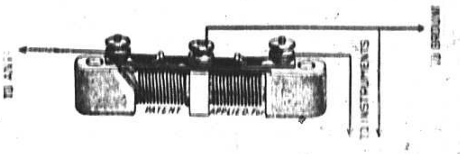
If a head set consisting of a pair of telephone receivers instead of a single telephone receiver is used, the cost of this item may be about $8 instead of $4. Still more efficient and expensive telephone receivers are available at prices ranging up to about $20.

*Editor's Note.*—This article was written in March, and owing to the great demand for Radio apparatus the prices now are much increased. Also the above prices are based on selling prices in U.S.A.

### FAMOUS DETECTIVE TELLS THIS ONE

William J. Burns, Chief of the Department of Justice Bureau of Investigation, told a story recently in which radio took the part of Sherlock Holmes. A dapper and bright young man appeared one day before the sales manager of a large radio manufacturing plant, and explained that he wanted to purchase a very fine receiving set for a local high school. He was greeted cordially and the best of the house's set were demonstrated. Ordering an expensive set, he managed somehow to secure delivery without payment, and then disappeared. The set also vanished from the place it had been shipped to originally, much to the chagrin of the manufacturers, who decided to advertise their loss through radio itself, being able to give a very accurate description of the young man, who had a noticeable scar on his cheek.

Chapter two opens in an apartment where a genial and fine appearing young man, with a scar on his cheek, is entertaining his friends with a new receiving set. Suddenly the instrument begins to tell of the manufacturer's loss and give a detailed description of the thief —unmistakeably the host! The consternation of the guests may be imagined. The next morning a very worried mother paid for the instrument which her son had wanted so badly, he had evolved the above scheme for getting it, whereupon the manufacturer dropped the matter.—Exchange.

# ARGUS LIGHTNING ARRESTER

## RADIO TYPE

Especially adapted for protection to Radio Receiving Sets against damage by lightning. It is as efficient after lightning has passed through it as it is before, and it does not deteriorate or change in capacity as do arresters of the vacuum type. It requires no attention—all, you have to do is install the ARGUS ARRESTER in your antenna circuit and forget to worry about damage to your Home or Receiving Set, even during the most severe lightning storm.

The Argus Arrester is built for rough weather, and has seen 18 years of active service, therefore can be depended upon.

It eliminates the necessity of a costly lightning switch. You will never be sorry because "You forgot to throw the switch" as there are no switches to throw. It is fool-proof. It acts as a filter for static.

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## SPECIAL

### LOOSE COUPLER SET

100 ft. Aerial Wire
1 Ground Clamp
4 Pr. Cleats
1 Slide and Rod
1 4½ x 8 Paper Tube
2 Long Slide Rods for secondary coil
4 Binding Posts
Galena
Federal 2,200 Ohms Phones—Double Condenser
1 6000V double throw single pole knife switch.
1 lb. 22 Gauge Enam. Wire
¼ lb. C. covered 28 Gauge Wire.
10 Contact Points
1 Switch Arm
1 3½ x 8 Paper Tube
Detector

**PRICE $22.50**

### CRYSTAL SET

100 ft. Aerial Wire
1 600V double throw single pole knife switch.
1 Ground Clamp
½ lb. 22 Gauge Enam. Wire.
2 Slides and Rods
4 Binding Posts
Detector
Galena
Federal 2,200 Ohms Phones—Double Condenser
4 pr. Cleats
1 3½ x 8 Paper Tube
2 Wood Blocks

**PRICE $19.75**

The above prices include Blue Prints and full instructions.

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Concluded from page 16

until a sensitive spot is found and the pressure is varied until the signals are heard with maximum intensity. The end of the wire should be clipped off every few days to present a new surfac and a thin layer of oil may be put on the crystal to exclude moisture. A disadvantage of this type of detector is that a slight mechanical shock may disurb the point and throw it out of adjustment.

It seems that when certain substances are placed together in not too close contact they have the property of producing a pulsating direct current when an alternating current passes through them. In some crystals the ratio of current flow is as high as 400 to 1, that is, current flows in one direction 400 times as easy as in the opposite direction. This rectifying action takes place between the galena crystal and the fine copper wire and the high-frequency currents generated in the receiving circuits pass through this crystal rectifier, in part at least, and the resulting pulsating direct current flows through the windings of the telephone receivers and affects the diaphragms.

There must be some kind of apparatus to change the audio frequency current into sound and the telephones serve this purpose. The magnets of the telephones are wound with very fine silk-covered or enameled copper wire so as to get the greatest number of turns in the smallest possible space and the resistance is anywhere from 1000 to 3000 ohms. This makes an extremely sensitive device which responds to very small currents.

A small fixed condenser, that is, one whose capacity is fixed, is usually shunted across the terminals of the phones. The impedance of the phone windings is considerable and the condenser serves as a by-pass for the radio frequency current, the detector and phones being connected in series, but the audio-frequency pulsating current passes through the phone winding.

There are a number of these "crystal" home receiving sets on the market to-day and they are satisfactory for local receiving. These sets usually consist of a variable inductance, a crystal detector and phones with fixed condenser. The inductance consists of a single layer of wire with taps brought out to switch points so that more or less turns can be used as desired.

Anyone, with little trouble and less expense, can construct a portable receiving set which will enable them to receive music or code signals. Hang about 75 feet of bell wire out of the window for an aerial and use the radiator or water-pipe for a ground.

To make the most simple kind of portable set get the following material:

A cardboard or wood box three inches square by two high.

An empty spool ¾ inch in diameter by 1½ inches long.

Enough No. 28 or No. 30 insulated copper wire to wind one layer on the spool.

A small battery clip to hold a piece of tested galena.

Two or three inches of No. 36 bare copper wire. Mount so that one end rests lightly on the galena.

Three binding posts.

One pair 2,000 ohm Murdock phones.

Connect the aerial to one end of the spool winding and the fine wire to the other end. The second end of the fine wire rests on the galena. Connect the clip to ground and shunt the phones around the galena. Wiggle the free end of the fine wire around on the galena. You will be surprised!—H. A. Eveleth, in Radio (U.S.).

## AERONAUTICAL DIGEST

Moving pictures have been taken at Camp Borden showing details of the training of officers and men from the very beginning of the course to its completion. These pictures are to be shown in all the moving picture theatres throughout Canada.

It is rumored that the Minister of Militia at Ottawa has been making very extensive inquiries throughout the country to find out whether an amalgamation could be made under the Department of Defense at Ottawa of all the Naval, Military and Air Force units.

Should this be maintained the views of the local airmen here are that this could be undertaken by the Air Force (see January, 1921, and July, 1921, issues of Aviation & Wireless News).

2. That the Air Force should be maintained as a unit force, but for the purposes of administration should be amalgamated with the Naval, Military and N.W.M.P.

3. That there shauld be a school for boys and young men, who should be between the ages of 16 and 21, to train them as mechanics. These graduates would be useful in civil service or in time of war would form a reserve.

4. New blood for officers should be recruited from the universities of Canada and meet for four months each summer for three years for training in flying.

5. These flying schools should be located at convenient centres througout Canada, and if necessary the machines could be moved from one school to another as required.

6. That we need permanent instructors for officers and men.

## AUSTRALIAN AIR FORCE

A statement was issued recently indicating the curtailment in the activities of the Royal Australian Air Force consequent upon the reduction of the Defence vote. Generally speaking, the formation of an air force for defence purposes in Australia has been made possible only by the generosity of the Imperial Government in forwarding gifts of equipment. The present policy in building up the air force is to endeavor, as far as possible, to supply aircraft to enable the fullest measure of co-operation to exist with the naval and military forces. Unfortunately, as matters now stand, these activities will have to be curtailed in many directions.

Negotiations are still proceeding for the purchase of a site on Sydney Harbor for a seaplane base. Owing to the generosity of the British Covernment, the Australian Air Force obtained many modern aeroplanes and seaplanes of various kinds. These include six Fairey 3D seaplanes, which are not in use at present.

A plan is being prepared by the department for the training of citizen forces in all branches of flying, with the exception of seaplane work. It is unlikely, however, that this scheme will be brought into operation for some time.—*Sea, Land and Air.*

## NEW KELLOGG PRODUCTS

The Kellogg Switchboard and Supply Co. are making a head set which is claimed to be as efficient as it is light in weight and small in size. The shell is non-metallic and encloses all terminals. The cap is of the most approved design, the concave surface being the result of years of practical telephone receiver construction. When two people desire to use one set or one receiver each in listening, the head band is instantly removable and as equally easy to replace when desired.